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The Physiotherapy Review

Volume 17 Number 6

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Robin Hood's Barn

Leah C. Thomas

It is my plan to bring forth some evidence that greater motor coördination is gained in cases of cerebral palsy through exercises without conscious muscular effort than through formal exercises demanding conscious effort. To give the simplest illustration, take the well known peg board. A child with normal mentality cannot be expected to be interested in moving these pegs about the board as long as will be necessary to bring about actual improvement in muscular coördination. The physical therapist might well suggest that a playmate is going to be eight years old tomorrow and that we could surprise him by making a birthday cake and putting on eight candles. Our theory is that the physical therapist has doubly increased the therapeutic value of the peg board exercise by distracting the child's mind from direct effort and thereby bringing about a degree of desired relaxation in muscle tension before the child begins his exercise. His mind is busy imagining the cake and next he must be careful to put on the exact number of candles. The child has what appears to him as a grown-up job, a constructive job in several ways and one in which he will find pleasure throughout.

In the recent past among spastic children, muscle training has been considered the most important feature of the day's program year in and year out. Muscle training has been, and still is, so important that education has been delayed in order to allow the child to give the greater proportion of his energy to bring about improved coördination. Muscle training is still represented to parents and child as the essential factor around which every other phase of the child's life is secondary. But consider that in most cases even after progress has been made the child is still a spastic and unable to compete with normal children without too great a strain on an unstable nervous mechanism. In many instances the child is still so dependent upon his parents that we find either the father or mother or both giving sympathy and physical care almost beyond average human endurance.

While here and there one spastic is found who is able to compete successfully with normal children or adults it is certain that the majority of them, even those with superior mentality, are not going to be able to do this. The very nature of their handicap is cruel. Too frequently these children are misunderstood and too frequently they are made the center of attention. In both cases, personality difficulties develop from early years. It is of equal importance to see the spastic as a child as well as a medical case. Compare the daily experiences and limited adventures of the spastic with the daily experiences of normal children.

A doctor visited camp not long ago and when his back was turned, one child, in his usual hesitating monotonous voice, said, "I know that doctor—when I was four years old, he told my mother that I could never learn anything." This was a poor start for a child who has an unconquerable handicap. He is ten years old now. He uses a typewriter. His poems are full of feeling. He has an inquiring mind. When he left camp after his first summer he solemnly said that he thought he could not come back the next summer because he had so much to study. His new found world of astronomy and nature study made him actually feel that he wanted to go home where he knew his parent would teach him further. He did return and last summer Mr. Beebe's explorations were so interesting to him that a less interested counselor was made miserable by having to hunt for details concerning fish half a mile deep in the sea. This child lives near Boston but he has not been able to have a teacher come to his home from the public school system. The personal contacts in this child's life are very limited. Therefore it is important for the physical therapist to give him mental stimulation as well as muscle training. In this case there would be therapeutic value in leaving him with more than a set of formal exercises.

Not only for sentimental reasons but also in a medical article of Dr. Earl Carlson, justification is found for the emphasis we are placing on the attempt to bring about a simultaneous mental and physical growth. To quote, "The delay in mental development in the spastic athetoid group is usually accounted for by the lack in that process of mental growth which proceeds by touch and grasp in every normal child. I feel that it should be the other way around. That is, the lack in muscular control should be accounted for by the lack of a rounded educational program for that child." In the same article is this statement, "We are prone to give too much attention to the muscle and to make the treatment of the spastic analogous to the treatment of anterior polemylitis."

At the Fourth Texas Conference on Child Health and Protection we find in an address by Dr. Carlson—"The solution of the problem of the spastic does not

Robin Hood's Barn, Ascutney, Vermont.
Read before the Massachusetts chapter of the American Physiotherapy Association, Boston, November 2, 1937.

merely revolve around a set of muscular exercises." Dr. Carlson further states that muscle training contributes little or nothing to the progress of the individual as a whole unless he learns how to inhibit the sensory stimuli which interfere with his muscle coördination.

Dr. Carlson finds "among the spastic athetoids who are successful in business or professions, that this success is due to opportunities afforded them to develop the unimpaired areas of their brains, or the assets at their disposal. As these assets develop there occurs a simultaneous improvement in muscle control as is illustrated in the case of a spastic girl who learned to play the piano before she could feed herself. Feeding, to her, was so much a matter of routine that she could not forget the things she did badly; whereas, her interest in music enabled her to cut out the sensory stimuli which were irrelevant to her playing the piano satisfactorily."

Coördination through unconscious muscular effort is brought out in the following paragraph. It is by similar schemes and plans that we give the children at Robin Hood's Barn more valuable muscle training than we have found can be gained through conscious effort. To quote once more from the same article of Dr. Carlson's: "The beginner at the piano may experience as much difficulty in placing the right finger on the right key as the spastic does in learning to handle a cup. Through practice the piano player learns to limit movement to certain muscles and eventually is able to play a well-practiced piece without much conscious effort. The difference between a normal person acquiring a skilled act, such as playing the piano, and the spastic learning to handle a cup is not so much a matter of complexity of muscular movement as it is direction of attention upon the purpose of the act. The pianist is not interested in muscle training per se but in a purpose; he wants to play the piano, and his muscular skill increases as he forgets himself in his music and learns to play without conscious effort. The hand of the spastic likewise becomes more agile as he forgets himself in his work. This is illustrated in the case of a chemistry student with bilateral athetosis. He could hardly feed himself when he entered college. Through studying chemistry he developed considerable manual dexterity. When he started laboratory work, fear of acid burns made him spill solutions although he had no difficulty in handling two empty beakers. As he learned to pay attention to the chemistry problem involved in his laboratory work, fear abated and manual control increased. The manual ability thus gained meant more to him than any amount of conscious muscle training he had ever undertaken."

At Robin Hood's Barn we believe that:

I. A well rounded educational program (including academic work and well planned exercises) will bring about simultaneously mental growth and improved muscular coördination. The outstanding factor common to both these phases is interest; interest in the subject matter and interest in purposeful exercises.

II. Mental growth can best be brought about by developing the assets possessed by each individual.

III. Time and effort spent in muscle training which does not interest and stimulate the child definitely makes that child muscle conscious and retards general improvement.

IV. Carefully planned exercises taught by an indirect method, as described in this paper, do bring about satisfactory results and by this method the child is made less muscle conscious rather than more muscle conscious.

It might appear to the casual observer that hit and miss good-time activities are going on at Robin Hood's Barn. We expect the trained observer to see the therapeutic value in all of our work. It is our claim and boast that the day is so planned that each child receives more muscle training and far more beneficial muscle training than is possible in the average daily program of spastic children living at home.

We must limit ourselves to a few brief hints concerning a plan of muscle training. The varying degrees of arm and hand skills with which we are so familiar bring to mind the following example: On a hot August day a favorite pastime is to sit at a table on which there are two or three pans of water. Last summer one child made his boats by scraping the bark from an apple tree. It was great victory for him when the boats fell directly into the pans of water. But always there were bark boats to be gathered in from the table or by worse luck the child sometimes found that he had quite a laborious task ahead in gathering up the boats that had dropped to the ground.

To analyze this situation—the perfection of the setting is not to be considered. The fun that we all find in playing in dishpans of water is not to be considered. Primarily the child is placed in this situation because it is ideal for muscle coördination exercises. The first few days the child may be left alone. After this time the boats on the ground are apt to be left there and interest is waning in gathering the last ones from the table. In other words we are beginning to lose the very motions we want for coördination. The physical therapist's duty now begins by joining in the play. Two or three bright colored toy boats would add interest and contrast to the black bark boats which no longer appeal. Large boats and small boats would give opportunity to explain how much deeper the water must be in harbors where trans-Atlantic boats dock than for smaller ones. Make a harbor and put these boats in. Some children might be at an age where even the simplest statements about the tides could be taught. Have the child pour the water very slowly and make the tide come in and go out. For older boys or girls information about the Panama Canal would add to their education. Interest and muscle training could go on for days by changing the pans. Put a big round one on each end and connect them with a long narrow cake tin. Here we have a first acquaintance with the Atlantic and Pacific oceans connected by the Panama Canal. Actually sail these boats through the Canal and carry on the boats imaginary cargoes as they do go over the route. And so on until this muscle training scheme leads into geography or history or both. And here is muscle training without muscle conscious effort, brought about in the same way as the spastic who improves in playing the piano as she became more and more interested in the music and less in conscious finger action.

Nature week gives us the job of tying tags with names on many of our bushes and trees, and for some children this is muscle training. Gathering stones and placing them on shelves for exhibition is muscle training for some.

Over our heads in the dining-room is a blue sky with stars, planets and constellations. And it is an excellent coördination exercise for any child who needs this very thing to take a pointer and tell the younger children about these stars. It is a fact that has been noted that as they become interested in their story they have less trouble pointing to the exact spot. If we said "point to the North Star" the child would pull his forces together, would not be so relaxed as when lost in his story, and his pointing would be labored and awkward.

Last summer our music and speech instructor was a person with long experience in teaching at Perkins Institute. Well she knew that most of us needed individual speech drill. So well she knew this that before leaving she left to every child and counselor a legacy of "e a i o u's and may me mah moh moo's" to be said and sung daily this winter in every known key, tone, volume and rhythm. She held her first lesson in assembly with every camper sitting in a large circle. She was a stranger to all of us. Assembly had been going on for some time and it was not early in the morning. With great dignity Blondel, our teacher, walked across the circle, shook hands and said, "Good morning, Little John." Little John was so surprised that she replied "Good morning," in tones of astonishment. With no change of expression on her face Blondel went directly to another counselor, shook hands and said, "Good morning, Will Scarlet," "Good morning, Robin Hood," "Good morning, Friar Tuck," and by this time we had realized that of course she wanted the same clear cut, well enunciated reply, "Good morning, Blondel," which she had given to each of us. We were now in gales of laughter to realize that we had been shown up and had put over our side of the show about equal to third grade school children. On went this wise Blondel to the children, "Good morning, Fair Ellen," "Good morning, Alan-a-Dale," "Good morning, Queen Eleanor," and between the seconds of laughter came each child's reply, "Good morning, Blondel," in as clear a tone and with as big a breath as each one could muster. Those children sensed that the counselors had failed. They had a chance to make good and put one over on us. Theirs was not perfection in speech, but each one did his very best according to his ability. Each one was raised out of his usual poor habit of speech and in the spirit of the joke this was no time for mutterings and monotones. No child was made self-conscious. This is a simple story but success in our speech training was due to this clever beginning. It formed a framework upon which the speech drills were based. For the large group work during assembly the teacher made many valuable lessons of equal interest to the counselors and children. At other times of day the children were taught individually.

During the morning assembly we sing many songs. Some of them are selected for slow rhythm in order to give a better opportunity for certain children to pronounce more words. Songs are selected with a view to improving the breathing. These are wind songs, bugle songs, and echo songs. Last summer the volume in the group singing improved noticeably. This meant a stronger and better controlled diaphragm. If through singing we bring about improvement in breathing, especially deeper rhythmic breathing, we soon find a carry-over from this to improvement in speech.

Part of the rhythmic dancing is done sitting down. This is an excellent time to emphasize good posture, to give exercises that strengthen the back muscles, to give arm extensions in all directions and to give arm pronation and supination to music that is helping through its perfect rhythm.

We dramatize games and songs—each one takes part with or without help. One of the favorite games is Little Sally Waters. Little Sally sits in the center with her two hands over her face "crying and weeping for a nice young man." Getting her two hands up to her face may be difficult, but she is part of a show, and the "show must go on." "Rise, Sally, rise." It is of no importance that Sally has to be assisted to her feet. She wipes away her eyes with definite arm and hand motions and does not even notice that she has to be helped to fly to the east, fly to the west—so intent is she on deciding whom she will choose as the one she loves best.

For children who seem at the point of stepping out alone but have slight balance difficulty, we recommend our popular doughnut table. This may be any old table with a hole in the center and the child standing in the hole. This situation gives us an opportunity to kill two birds with one stone. The child should have on the table the type of toys which best fits his need for arm and hand exercises; blocks with letters or numbers, a wooden mallet is very much appreciated for driving nails (most of us find a hammer unsuited for its purpose), picture puzzles, dominoes or flinch cards, crayons, and for younger children, rolling large or small colored balls. Finger painting should be done standing rather than sitting so this is an excellent time for finger painting. Children will stand for an hour or more in this table without being tired. There is no better way to strengthen the leg and back muscles and at the same time keep the mind occupied with games which definitely improve arm and hand coördination. This touches very closely the activity of normal children.

Before the conclusion, comes a word about relaxation. To most of us the word "relaxation" used therapeutically means conscious relaxation. This form is important for the child with cerebral palsy and he should be taught to relax for short periods through conscious effort. We also use the word to mean the kind of relaxation which should be maintained throughout the day. This can come only from a feeling of well being through physical comfort, security and contentment of mind.

The first principle in maintaining this continuous relaxation is to make the child comfortable and give him a feeling of security at all times. The chair should be low so that his feet are on the ground with his heels touching the floor. If a child has such poor balance when sitting that his position is precarious, it seems to us that it is better to strap him in so that he does not have the constant fear of falling. Many of these children have so little control over their hands that they are continuously hitting their hands against hard objects. This should be taken into consideration in leaving a child alone. They often ask to have nearby objects removed for fear that they will hit them or knock them over. As far as possible we should see that chairs, tables and other apparatus are as stable and secure for these children as ordinary furniture is for the normal child. So much for the physical security.

Now for the contentment of mind. How do we fill our unoccupied moments? Few of us enjoy doing nothing. If we are to have an enforced wait in a doctor's office or a railroad station, we usually provide ourselves with reading material. A normal child if left alone usually finds something to do. He does not sit in a chair gazing into space. He may go to the window and become absorbed in watching the passers-by or the outdoor world. He may investigate various objects in the room or busy himself building a train out of stools and chairs. Many children with cerebral palsy have to remain in whatever position they have been left. They may grow impatient and unhappy, and in doing so increase the tendency of the muscles to become spastic.

It is a simple thing to prevent this by giving him something to watch, or to think about. Suggest to him that he make up a story about a picture in the room. If he has been taught to understand maps, pin a large map on the wall and tell him to find certain cities, or count

the mountains and rivers. If he is sitting or lying by a window he may count the cars that go by in a given time, or recognize the makes of the cars. It may interest him to watch the clouds, the birds, or growing things. It will be an incentive in stimulating his interest if he thinks that you too are interested in these same things. Watching all of these things would be a means of training his perceptions and enlarging his field of interests.

These children may gain much happiness by having their imaginations trained. They can find joy in a world of make believe in making up stories and in telling them. If you share this make believe world with them the danger of the over-developed type of day dreaming will be eliminated. Older children can utilize the time spent in solitude in making up poems, and plays, planning programs for family parties, perhaps in planning the family menus. Castles in Spain may tide over many tedious hours of solitude and bring added happiness.

A happy person is a busy person. However, being "busy" does not necessarily mean running around, knitting, or doing errands. Business of mind is fully as essential to happiness, and if a child feels that he can share the fruits of his mind with you and that you feel that all the interesting things he sees are interesting and important, his world will be a happy one.

The therapeutic value of maintaining this unconscious relaxation should never be forgotten. This principle underlies every program at Robin Hood's Barn.

There never has been a child at Robin Hood's Barn who has not had an individual plan for muscle training underlying his daily program or who does not receive much individual attention in carrying out this training. At first we rejoiced that we had succeeded in the very thing for which we stood, indirect muscle training or an attempt to improve coördination without conscious muscular effort. We explained this to the parents but it seemed like a big jump from the typewritten list of ten exercises to be done ten times each morning at ten o'clock. It was a feather in our cap, from our point of view, to have the children tell their parents that they had had no exercises during the summer. We had succeeded in our slogan "without conscious effort" and the children had made definite improvement.

But heavy hangs the head that wears this golden crown because of the misunderstanding to which it leads. One of our best friends, a physical therapist who continues to send a camper or two every year assures the parents that this is the best place in the world to come for a vacation. We never know whether the vacation is to get away from her or the parents. No one at Robin Hood's Barn is on an incoördination vacation we assure you.

We have heard that so ideal an environment cannot exist elsewhere but if the time ever comes when the spastic receives the same consideration and money that the feeble-minded children do at the present time they will benefit more by schools and institutions working along the lines described in this paper than by following the present day methods of caring for these children. We claim that our methods are practical and can be carried out in homes, schools and institutions.

In our book and in every article on Robin Hood's Barn we have emphasized the theory of making the children enjoy their work and play. We wish again to emphasize this point because we find that it is the first secret in maintaining relaxation and in holding interest in their work. Physical relaxation and interest in learning are fundamental principles upon which to build constructive training for these children.

Radiant Energy, Chiefly in the Ultraviolet Band

Katherine King, B.A.

The employment of radiant energy, popularly misnamed "light therapy," is one of the most useful physical measures at the physician's command. That part of the electro-magnetic spectrum extending from far infra-red (150,000 angstrom units) through visible light and far ultraviolet (1,800 angstroms) is commonly utilized. Infra-red is used for producing heat effects,—ultraviolet for procuring chemical changes in body tissue. Table I (Coblentz) indicates the different spectral regions, probable depth of penetration and possible physiologic action of rays from different sources in angstrom units.

The sun would be the best source of radiant energy for therapeutic purposes if it could be depended upon. However, there are wide variations in solar radiation intensities measured at the surface of the earth owing to such factors as altitude, season, humidity, dust or haze in the atmosphere, and relative position of the earth and the sun. Wavelengths shorter than 2,900 angstroms rarely penetrate the earth's atmosphere to sea level. Consequently, artificial sources are used because the emission

TABLE I

Spectral Region	Penetration of Rays	Physiologic Action	Source
Far ultraviolet 1,800-2,900 A	Superficial 0.1 to 0.5 mm.	Photochemical	Metals in carbon arc and spark of metals (Hg. arc)
Near ultraviolet 2,900-3,650 A	Superficial 0.5 to 1 mm.	Photochemical	Sun; metals in carbon arc; arcs of metals
Visible spectrum 3,900-7,600 A	Superficial 1 to 5 mm.	Thermal; nerve stimulation	Sun; carbon arc
Near infra-red 7,600-15,000 A	Deep 10 to 30 mm.	Thermal; nerve stimulation	Sun; carbon arc; gas-filled tungsten lamp
Far infra-red 15,000-150,000 A	Superficial 3 to 0.1 mm.	Thermal; nerve stimulation	Carbon arc; infra-red (radiant) heaters

These values represent limits in depth at which effective biologic action may be expected.

57 East Bellevue Place, Chicago, Ill.

is more constant both in quality and quantity, or spectral distribution and intensity.

The Council on Physical Therapy of the American Medical Association classifies ultraviolet generators as sun lamps or therapeutic lamps according to their spectral range and intensity. Those lamps emitting ultraviolet radiation not differing essentially from natural sunlight of the clearest weather midday, midsummer, midaltitude and at sea level have been designated as sun lamps. These lamps are for home use by the patient. The ultraviolet radiation in these units is so controlled that scarcely any wavelengths shorter than 2,900 angstroms are emitted. At a specified distance, the ultraviolet radiation is comparable to that of midsummer sunshine. The minimum intensity for these lamps is such that a sixty minute exposure at twenty-four inches will produce a minimum perceptible erythema. Therapeutic lamps have a wider spectral range and greater ultraviolet intensity. Because of the high intensity of ultraviolet radiation, one must realize the potential danger from this type of generator.

ULTRAVIOLET

1 Sources of Ultraviolet; Spectral Range and Intensity.

A. The *carbon arc* simulates natural sunlight more nearly than any other artificial source of radiant energy in distribution of spectral emission. It is predominantly infra-red. The characteristic spectrogram consists of numerous fine lines so close that the spectrum appears continuous, like that of sunlight. The radiation at 3,890 angstroms is stronger than in the sun's spectrogram. However, the two should not be compared, owing to factors not pertinent to this presentation.

Radiation from the carbon arc depends on three things: (1) Size and kind of electrodes used (color of flame); (2) direction of the current when direct current is used through combination of neutral cored or impregnated carbons, and (3) the amount of current used.

The high amperage arcs are more efficient than low amperage arcs in production of ultraviolet and visible radiation. With 25 to 30 amperes of current, a carbon with diameter of 12 millimeters will supply an efficient radiation for therapeutic work. If only 8 to 10 amperes are available, electrodes should be chosen with diameters from 6 to 8 millimeters. In addition to size, the type of electrode will determine the kind of radiation. The following outline, summarized from Coblentz, gives the color of flame of various arcs and radiation characteristics of each. The color of the flame depends on the type of metal with which the carbon is impregnated.

(a) White flame ("therapeutic A" or "sunshine carbons"). Most nearly comparable to solar radiation. Carbon impregnated with oxides, yttrium, etc.

Very little emission in ultraviolet below 2,900 angstroms.

High emission in ultraviolet from 3,000 to 3,400 angstroms.

Strong emission at 3,890 angstroms (giving characteristic color).

Strong emission from 4,500 to 5,000 angstroms.

This is used with a chimney or Corex D screen to absorb ultraviolet below 2,900 angstroms and infra-red longer than 40,000 angstroms, thus copying the sun's spectrum. (30 ampere arc, 13 millimeter carbon, 30 inches distance to patient compares with noon day sun in June at sea level.)

Without screen	With screen
5 percent ultraviolet	5 percent ultraviolet
50 percent luminous	62 percent luminous
45 percent infra-red	33 percent infra-red

(b) Blue flame ("therapeutic B"). Carbon impregnated with iron oxide. Range from 2,200 angstroms (ultraviolet) to 40,000 angstroms (infra-red). Greater percentage of ultraviolet radiation is below the 3,100 angtroms band. From this particular carbon one is able to secure a greater percent of ultraviolet radiation below the 3,100 angstroms band than from any other.

(c) Yellow flame ("therapeutic C"). Calcium oxide in carbons.

Range from 2,200 angstroms (ultraviolet) to 40,000 angstroms (infra-red).

Strong ultraviolet emission at 2,900 to 3,200 angstroms.

Strong visible emission from 5,000 to 7,500 angstroms.

9 percent ultraviolet.

24 percent luminous.

67 percent infra-red.

(d) Neutral carbon core ("therapeutic D," not often used).

Little ultraviolet below 3,200 angstroms.

Concentrated cyanogen band with maximum intensity at 3,890 angstroms.

(e) Red flame ("therapeutic E"). Carbon impregnated with strontium.

Range from 2,200 angstroms to 40,000 angstroms.

Strongest emission in visible band from 5,500 to 7,500 angstroms.

When direct current is used, it increases the radiation of the positive electrode, particularly at 3,890 angstroms. Little effect on the ultraviolet or visible radiation.

B. The *mercury quartz lamp* is another source of radiant energy. Its radiation is predominantly ultraviolet. The emission consists of a series of intense spectral lines superposed on a faint continuous spectrum, ranging from 2,570, 2,650, 2,804, 2,967, 3,020, 3,130, 3,340, to 3,650 angstroms. There is little infra-red radiation except at 10,000 to 12,000 angstroms. Non-penetrating long infra-red rays are radiated by the lamp housing. The resonance emission line at 2,537 is practically of the same intensity as the line at 3,020 and 3,130 angstroms.

There are two principle types of mercury burners used, the "hot" and "cold" quartz mercury types. The first is the earliest known lamp; it operates at high vapor pressure and a relatively high temperature. The burner requires 3 to 4 amperes of current and operates at a low voltage (from 65 to 70 volts). Some lamps have solid tungsten anodes, others liquid mercury anodes. Both types have practically the same ultraviolet emission, if the input is similar. Air-cooled burners with either type of electrode operating on alternating current or water-cooled burners on direct current line have a higher ultraviolet output than air-cooled burners operating on direct current since in the former instances the burner operates at a lower temperature and is cooler. Because of this, the water-cooled burners are used for close applications since they will not burn the skin.

The "cold" quartz lamp operates at low vapor pressure, low amperage (0.015), high potential (5,000 volts), and has a glow discharge similar to the original Geissler tube. Little power is consumed. Therefore, the burner does not get hot. Of the total radiation of all wavelengths less than and including the line at 3,130 angstroms, more than 95 percent occurs at 2,537 angstroms. The erythmogenic efficiency is high, but that is not necessarily a criterion of its suitability for therapeutic purposes.

The type "G" mercury glow lamp is a burner of the

foregoing type. However, the spectral energy distribution of this type of mercury vapor radiator is similar to that of certain sun-lamps since the total ultraviolet emission is rather low.

The "Mazda Sunlight" lamps, S-1 and S-2, are recommended for home use. Here the radiation from each bulb comes from two sources, the tungsten arc and the mercury pool. The emission line is as follows: Strong ultraviolet at 2,800, 2,967, 3,020, 3,130, 3,340, 3,650, 4,050 angstroms superposed on a continuous spectrum; from tungsten, 3,650 angstroms through visible and the deep infra-red radiation.

II Physiologic Effects of Ultraviolet:

Because of the difficulty in isolating certain parts of the spectrum for therapeutic purposes, the specific effect of a given band of certain wavelengths cannot be determined at the present time. As already noted, each source has a combined output of ultraviolet, infra-red and visible light although the proportions differ in different lamps, as well as the range. It is believed that wavelengths shorter than 2,900 angstroms have definite bactericidal effects whereas those over 2,900 angstroms (ultraviolet) have an actinic or photochemical effect.

The best known chemical effect is noted in connection with the skin ergosterol which produces Vitamin D on absorption of ultraviolet emissions. Another result of ultraviolet radiation is the deposit of melanin in the pigmentation layer of the skin. Calcium absorption has been noticed to increase after radiation over a long period, so that a metabolic effect may be claimed. Ultraviolet radiation of requisite intensity will produce an erythema. This, in turn, may be slight, mild, severe or result in a real dermatitis with blistering. Recognized authorities claim that ultraviolet radiation predisposes to malignancy in certain cases.

III Dosage of Ultraviolet:

Factors influencing dosage are as follows: (1) Intensity of source; (2) spectral distribution; and (3) the individual patient.

Concerning intensity of source, the Council on Physical Therapy of the American Medical Association has adopted 20 microwatts per square centimeter of homogenous radiation of wavelength 2,967 angstroms as the erythemal unit of dosage. However, it is difficult to measure the intensity of a lamp in microwatts per square centimeter. Hence the erythemal reaction has been decided upon as the best test for judging the ultraviolet efficiency of any source clinically.

This test is most easily performed on the patient's arm or thigh. (Since it leaves tan spots, certain patients will prefer having these out of sight.) Six to ten round holes are cut in a piece of cloth which is placed over the extremity to be tested. The rest of the part is draped. Then the lamp is focused at a convenient operating distance from the patient (measurement taken and kept) and the radiation started. The first hole is covered after a unit of time (half a minute, or one minute), then the succeeding holes are covered after similar intervals of time. The patient is examined at the end of twenty-four hours. Certain "holes" will have taken, or show an erythema. In this way, the physician may choose the type of erythema he wishes to duplicate on that particular patient.

It is well to keep in mind that fair people and very young children or older people tan more readily than brunettes or young and middle-aged people. Also the skin is more moist in summer and absorbs radiation more easily than in winter.

The intensity of radiation of any mercury quartz lamp will deteriorate with age. Consequently, it is necessary to make frequent tests (every three months or so) to determine the probable effectiveness of the erythemogenic radiation.

It is well to keep in mind two laws regarding the placement of the lamp in relation to the patient. The inverse square law states that the intensity of the radiation from any source varies inversely with the square of the distance from the source. Literally this indicates that the further the source is from the patient, the more the rays disperse into the atmosphere so that the intensity becomes increasingly less as this distance is increased. For example, the usual treatment distance is 36 inches from source to patient. If this distance were doubled, the patient would get only one quarter as much radiation as before. Correspondingly, if the lamp distance is halved, and placed at 18 inches, the intensity of the emission will be four times as great as it was at 36 inches. This is important to remember in dosage calculations.

The other law, the cosine law, states that the energy per square centimeter is proportional to a constant times the cosine of the angle made by a line connecting the source and the patient and the line perpendicular to the patient's body. The sum and substance of this is simply that the patient will receive the best treatment when placed at right angles to the light. Light falling on parts of the body not directly under the source loses some of its intensity.

It is customary to give infra-red treatments before ultraviolet as this hastens the absorption of the ultraviolet. General or local treatments may be given. Natural sunlight is often used for general systemic treatments. The time of radiation depends on the type of source and patient and must be judged clinically. Usually, an underdose is preferred to an over-dose. The time may be increased each treatment until the patient is receiving up to 15 minutes with a therapeutic lamp or much longer with a sun lamp.

Although ultraviolet has been prescribed for almost as many conditions as there are diseases, few of these claims are supported by clinical evidence. According to a statement issued by the Council on Physical Therapy of the American Medical Association in January 1936, evidence available at that time indicates that ultraviolet rays have a prophylactic and curative effect on rickets, infantile tetany or spasmophilia, osteomalacia, and lupus vulgaris.

Many conditions have improved upon administration of ultraviolet radiation but there is as yet no proof that this is due to the specific action of any certain rays. Cases in point are tuberculosis of the bones, articulations, peritoneum, intestine, larynx and lymph nodes, or tuberculous sinuses. Heliotherapy is preferable in treating such conditions but artificial radiation is used where the other is not available. Sluggish, indolent wounds appear to be benefited by radiation but this is not clearly the specific effect of ultraviolet. In some cases secondary anemia is also apparently benefited by radiation used as an adjunct to established methods.

It has not been conclusively established that ultraviolent radiation, given to a normal person, will prevent colds or increase the tone of the body as a whole.

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Physical Therapy: Its Value in the Treatment of Soft Tissue Injuries of Athletes

W. H. Northway, M. D.

The purpose of this article is to review the simple physical therapy procedures used in the treatment of the most common injury of athletes; namely, injuries to the soft tissue. A statistical study of "athletic injuries," especially football, has shown that the most frequent injuries are those of joints, muscles and bones, and in all these injuries soft tissue has been damaged.[1] The same statistical study has shown that the most frequently injured parts of the body are as follows, in order of their frequency: (1) knee, (2) ankle, (3) shoulder, (4) leg, (5) thigh, (6) hand, (7) head, (8) chest and ribs, (9) hips and pelvis, (10) nose, (11) acromio-clavicular joint, (12) back, (13) foot, and (14) neck. Physical therapy measures have proven to be of value in the treatment of soft tissue injuries;[2] therefore, these procedures are particularly useful in the treatment of injuries in athletics. The pathological changes which take place following injury to soft tissue are constant, but the extent to which the process advances depends upon the degree of trauma and the early treatment. If treatment is to be carried out on a scientific basis, the pathological changes must be understood by the therapist. It is understood, of course, that an accurate diagnosis of the injury has first been made by a physician, and that any specific procedures such as the reduction of fractures or of dislocations have been attended to by the physician.

Trauma to soft tissue results in torn and thrombosed blood vessels, lacerated tissue infiltrated by hemorrhage, inflammatory exudate with its cellular constituents, and the transudate of edema from circulatory and lymphatic obstruction.[2] With the above picture in mind, physical therapy can be instituted in a logical manner.

The physical therapy procedures found most useful during the past six years at Stanford University in the department set up for the care of injuries to athletes, under the direction of Dr. E. F. Roth and the author, are simple to carry out and the equipment is inexpensive. The procedures in general have two main purposes to fulfill; namely, prevention of further extension of the pathological process initiated by the original trauma, and to aid in the return of the traumatized tissue to its normal state and function as soon as possible.

As the pathological process develops, swelling of the soft tissue takes place, followed by pain and muscle spasm. If the swelling in the tissue is allowed to continue, the pressure of the fluid in the intercellular spaces is finally increased to the point where further extravasation ceases. This pressure, while it serves a useful purpose in finally limiting the amount of swelling which can occur, will at the same time, if allowed to progress to this point, impede the return of a good blood supply so necessary in the healing process. If the exuding of fluid into tissue spaces is to be prevented, it seems only logical that the blood and lymph supply to the part be temporarily diminished, and this can be accomplished in two ways; either by pressure or a lowering of the local temperature, or better by the use of both. Pressure is most conveniently applied by the use of one of the several commercial elastic bandages now on the market. These bandages get their elasticity from the weave rather than the material from which they are made. The initial cost of the bandage is high, but it stands washing well and can be used over and over again. It should be needless to warn that whenever pressure is applied, the degree should never be great enough to cut off the blood supply to the part distal to the injury. The temperature may be lowered by the use of cold or ice compresses, or baths. The length of time during which these two procedures should be carried on will depend upon the degree of injury, and no definite period can be prescribed. If the treatment fulfills its purpose, it must be continued until the extravasation of fluid has ceased.

During the time that pressure and cold are being applied, another procedure must be instituted; that is, rest to the injured part. Rest may be secured by placing the part in a relaxed, protected position or it may be necessary after the initial application of pressure, cold, and rest, to continue the same in bed.

Following the arresting of this process of destruction brought about by the trauma, it is necessary to direct the therapy in ways which will aid nature in bringing about repair as rapidly and with as little permanent change in the tissue as possible. The fluid and cellular debris which is occupying the intercellular spaces must be absorbed into the blood and lymph channels before it becomes organized into fibrous tissue and before it destroys the surrounding tissue cells through its pressure, diminishing their blood supply. The next job is, therefore, the application of measures which will increase the blood supply.

These measures to be of the greatest value must be started early, hours rather than days after the injury, for organization of the exudate begins at an early date.[2] The methods used in increasing the blood supply are heat, massage, exercise and elevation of the part, especially the latter if the injury is in a distal part of an extremity. Heat may be applied by several methods, such as compresses, baths, radiant heat and medical diathermy.

A very satisfactory method, if the anatomical position of the injury will allow, and if a fracture is not present, is the use of the whirlpool bath. A whirlpool bath consists of a metal tank into which water is run continuously and in such a manner as to produce a constant motion of the water in the tank. The temperature of the water can be regulated by simply increasing or decreasing the proportion of hot to cold water—no complicated mixing valve is needed. A pipe may be added to the intake which will pull air into the water circuit before it enters the whirlpool. The addition of air bub-

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bles into the bath enhances the value of the heat by producing a soothing sensation on the skin surface, the motion of the water acts as gentle massage, both aiding in the relaxation of spastic muscles. The method also allows early active motion with a minimum of work for the muscles. Plans for the construction of such a bath may be secured from the Council on Physical Therapy of the American Medical Association.

Radiant heat may be secured from two sources, depending upon the penetration desired. Experimental work has shown that with radiant energy from an incandescent lamp, using maximum skin tolerance as a gauge of dosage, the subdermal temperature at a depth of five-tenths centimeters rose to 47.7° centigrade while with infra-red radiation from an infra-red generator at the same depth the temperature attained was 41.7° centigrade.[3] If penetrating heat is desired, incandescent lamps have an advantage over infra-red generators whose radiations are absorbed on the surface, thereby heating the surface more than the deeper structure. Radiant heat in either form must be carefully supervised or the skin above the damaged soft tissue may be blistered. It will not stand temperature changes of a normal skin probably because of the deficient blood supply.

Medical diathermy is another useful method for applying local heat. The short wave medical diathermy seems to be the most convenient method for its application. At Northwestern University Medical School, the temperature of the skin of the subcutaneous tissue and of the quadriceps extensor muscle in human subjects was measured before and after twenty minute clinical applications of short wave medical diathermy. In these tests it was found that the electromagnetic field, or electromagnetic induction, was the most effective in its ability to heat the deep tissue of the human thigh.[3] If medical diathermy is used it should be used for a short period and at low intensity for the first few doses; thereafter the dosage and intensity will depend upon the reaction of the patient.

Massage may be used following the application of heat. It should be of a superficial stroking nature—never deep or kneading in type. The massage should begin proximal to the injured part and gradually descend; if great enough care is employed, gentle pressure may be applied over the traumatized tissue. Deeper stroking massage may be used as recovery progresses. Mennell in commenting upon the use of massage proximal to the injury for the removal of effusion has this to say, "You should first uncork the bottle before you try to empty it."

Exercise of soft tissue not accompanied by bone damage should begin early. Exercise increases the circulation to the part, thereby aiding the absorption of intercellular fluid, prevents the binding together of muscle, tendons, and areolar tissue by fibrous tissue,[4] and increases muscle tone, so necessary in the proper functioning of joints dependent upon the adjacent musculature. Exercise in a damaged muscle should begin with a minimum load.[5] This may be accomplished by submerging the part in a pool or Hubbard tank or by placing the limb on a powdered flat surface. The exercise should be increased as the tolerance to work increases. Muscles of the lower limb may be exercised following a sprained ankle by using a firm Gibney adhesive tape support to the ankle, crutches to support the body weight and then insisting that the muscles of the leg be used through their full range of motion by walking. The procedure may also be used for injuries about the knee. The exercise must be supervised at first to be sure the leg is being used in a natural manner but without weight bearing. Muscles about the shoulder may be exercised early either by the use of a powdered board with the patient supine, or with the patient leaning forward from the hips with the injured arm dangling at the side. This latter procedure will allow a greater range of abduction and elevation with less work being performed.

It has been recognized for some time by medical men interested in the injuries of athletes that injury to one portion of the body does not prevent strenuous exercise of other parts, especially if the injured part is protected. A sprained ankle is no contraindication to strenuous exercise of the shoulder, back and trunk muscles. Likewise, a dislocated shoulder does not hinder a strenuous workout on the track or gymnasium floor provided body contact with another does not occur. General body exercises with an injured part adequately protected keeps up the athlete's tolerance for work, allows him to return to his competitive sport in good condition as soon as his injury has healed, and probably during the period of treatment improves the blood supply to the injured part by keeping the general circulation active.

A common fallacy exists in the minds of laymen that injuries sustained by athletes are different and heal differently than those sustained in the ordinary individual. An injury received in an athletic contest is no different from a similar injury received at home, in the office, on the farm, or in a factory. The injury may heal more rapidly if intelligently treated but not differently. The same physiological processes are active in each instance. Physical therapy procedures in common use by those engaged in treating the injuries of athletes are equally of value in treating the same type of injury wherever it occurs. The procedures to be most effective must be instituted early, chosen intelligently, carried out gently but intensively, and continued until the pathological process initiated by the trauma has been replaced by normal tissue activity.

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In 1708 Gonzan Gotō recommended physicians to use mineral baths, massage and acupuncture. This is the beginning of the so-called physical therapy (in Japan).—*From "JAPANESE MEDICINE" by Y. Fujikawa, M. D.*

The Base of Support in Stance*

Its Characteristics and the Influence of Shoes Upon the Location of the Center of Weight

Frances A. Hellebrandt, Doris Kubin, Winifred M. Longfield and L. E. A. Kelso

According to Morton[1] the ease and economy with which man meets the prime mechanical disadvantages of the biped stance represents the acme of his physical evolution. The unfavorable factors are the height of man's center of gravity and the smallness of his base of support. Morton postulates that as long as the line of gravity falls within a certain sector of the area of underpropping, rotatory stresses will be equilibrated by increase in tone without resorting to phasic contraction of the antigravity muscles. He locates the center of gravity of a subject standing in a comfortable posture as perpendicularly above a point between the feet in the region of the navicular bones. Steindler[2] believes there is an inherent tendency for each individual to maintain his center of weight at a constant point in relation to the structural supports of his body. However, we[3] observed that sway is inseparable from the upright stance and that the center of weight shifts incessantly during the maintenance of a natural comfortable posture.

The object of this study was (1) to observe the base of support characteristics in stance; (2) to project the average location of the shifting center of weight into the base of support; and (3) to determine the effect of shoes upon the location of the center of weight and upon postural stability.

Methods

1. *Recording the Base of Support.* All observations were made in Morton's foot position of greatest stability in stance. In this posture the toes turn out so that the lateral diameter of structural support approximates the antero-posterior. The position was standardized by the insertion of a 30-degree wedge between the heels which were made to abut against a low vertical ledge. The subject stood upon absorbent paper after first moistening the soles of the feet with a concentrated solution of potassium permanganate. The contact area of the feet with the ground was recorded during five minutes of quiet standing. The resulting footprint was then analyzed in accord with the suggestions embodied in Morton's description of the functionally important diameters of support. The total area of underpropping was measured in square centimeters with a planimeter after introducing tangents to the heel, the lateral border of the feet and the toes. The diameter of antero-posterior stability was taken as the vertical distance between the heel tangent and a line through the heads of the first metatarsals, the latter being placed midway between the two in the presence of inequality in the length of the feet. The distance between the fifth metatarsals measured the lateral support. The accessory margin of anterior stability was taken as the distance between the first metatarsal line and the great toe tangent.

2. *Projecting the Center of Weight into the Base of Support.* Figure 1 illustrates the method and equipment. The subject stands upon the uppermost of two platforms placed at right angles to each other and supported on steel wedges to minimize friction. One knife-edge of each beam rests upon a hundred-pound platform scale modified to graphically record changes in weight upon a constant-moving kymograph. The subject faces the antero-posterior scale which records all forward and backward oscillations of the center of weight. A simultaneous record of sway in the transverse vertical plane is made by the auxiliary lever of the lateral scale. Knowing the weight of the subject, the distance between the knife-edges, the indications of the scales and the tares, the location of the center of gravity in the two vertical orientation planes may be determined at any instant by equating moments. Since the position of the feet is fixed in regard to the knife-edges in terms of which the center of gravity is located, the latter may be projected into the imprint of the base of support.

3. *Determining the Average Position of the Shifting Center of Weight.* The secondary of a slotted core transformer excited from a constant potential source was suspended from each auxiliary scale lever. Since the position of the scale lever is directly proportional to the former, the involuntary vibratory motion of the center of weight may be electrically integrated by placing the secondary of each transformer in series with the current coil of a rotating watt hour meter. From the reading of the meters the average load on the antero-posterior and lateral scales may be obtained and by simple calculation converted into the mean location of the center of gravity in the two cardinal vertical orientation planes.

4. *Modifying the Size of the Base of Support and the Height of the Center of Gravity by Wearing Shoes.* A series of consecutive 3 minute records was made standing in a comfortable posture in bare feet, wearing shoes with low (1.0 to 2.5 cm.), medium (2.8 to 4.5 cm.) and high (4.8 to 7.0 cm.) heels. Sufficient rest was allowed between each standing period to eliminate fatigue. Heel height was estimated by the difference in the tallness of the subject measured with and without shoes.

Results and Their Discussion

1. *The Characteristics of the Base of Support in Stance.* Observations were made on 88 professional students in physical education accustomed to vigorous exercise and possessing, by that functional criterion, essen-

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tially normal feet. The data are presented in Table I. These young adult women show a 63 per cent larger margin of static security laterally than antero-posteriorly in the foot posture of Morton, disregarding the accessory area of support which is functionless during stance in the average subject. The greatest lateral diameter more nearly approximates total foot length. Considerable variability was evident in the diameters studied, especially in the relative importance of the accessory area of support which is a margin of safety called into activity when the center of gravity shifts too far forward in the antero-posterior plane.

TABLE I

Characteristics of the Base of Support in Stance

	Mean	Standard Deviation	Coefficient of Variability
Number of subjects—88			
Antero-posterior foot support.....	16.43 ± 0.05 cm.	0.75 ± 0.04	4.6
Lateral foot support	26.78 ± 0.12 cm.	1.63 ± 0.08	6.08
Accessory foot support	6.10 ± 0.04 cm.	0.49 ± 0.02	8.03
Total area of underpropping	502.0 ± 3.37 sq. cm.	46.89 ± 2.38	9.3
Foot length.....	23.09 ± 0.07 cm.	1.00 ± 0.05	4.3

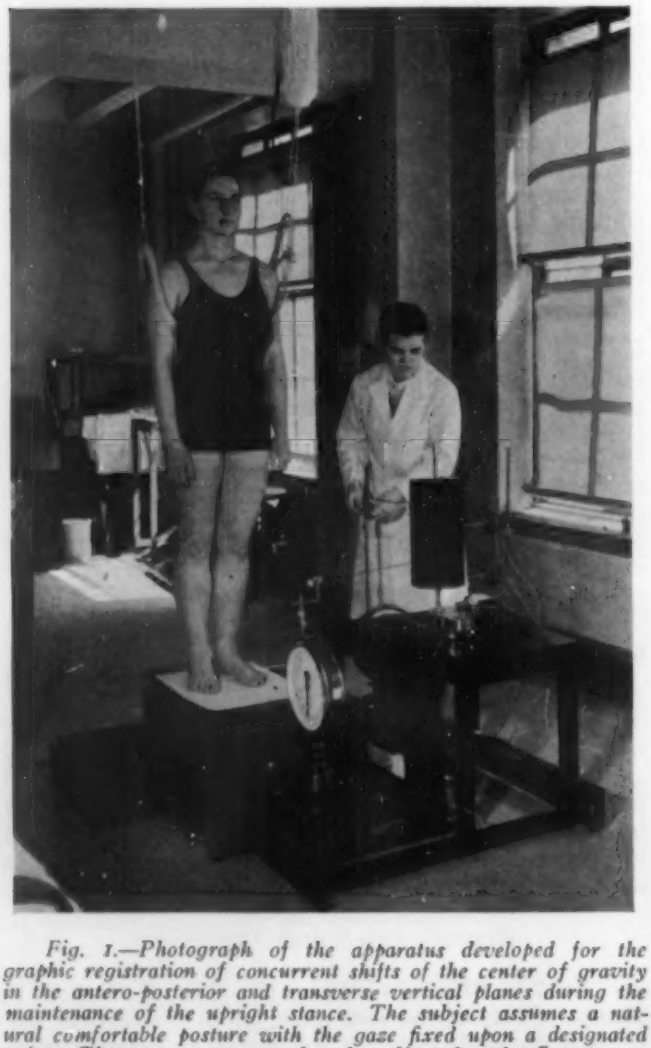

Fig. 1.—Photograph of the apparatus developed for the graphic registration of concurrent shifts of the center of gravity in the antero-posterior and transverse vertical planes during the maintenance of the upright stance. The subject assumes a natural comfortable posture with the gaze fixed upon a designated point. The arm straps are loosely adjusted and offer no restraint. Their function is protective in the event of syncope.

2. *The Location of the Center of Weight in the Base of Support.* The area of structural support in the foot position of Morton forms a trapezoid bounded by the intersection of the heel and lateral tangents and the extension of the horizontal line passing through the heads of the first metatarsals. The geometric center of the base of support may be approximately located by constructing an antero-posterior median from the midpoints of the heel tangent and the metatarsal line, and another, perpendicular to the first, bisecting it. The intersection of these medians marks the center of the active support. The projected average position of the center of weight within the base of support may then be mathematically related to the geometric center of the trapezoidal area approximating the superficial extent of the underprop space. The distance from the geometric center of the base to the center of gravity projection is called the eccentricity, $\frac{eAP}{\frac{1}{2}AP}$ and $\frac{eT}{\frac{1}{2}T}$ being the eccentricity ratios evaluating deviations as regards the antero-posterior and transverse areas respectively. (eAP = the perpendicular distance from the center of gravity to the transverse median. $\frac{1}{2}$ AP = half the length of the antero-posterior median. eT = the perpendicular distance from the center of gravity to the antero-posterior median. $\frac{1}{2}$ T = half the length of the lateral median.) Figure 2 illustrates the above points.

To support the center of gravity and uphold the body in the erect posture, the straight line joining the center of weight with the center of the earth must fall within the area enclosed by the feet. The average position of the center of weight falls relatively close to the geometric center of the base. That it is moderately eccentric was indicated by our[4] observation that the upright stance was asymmetrical in the majority of a group of 445 young adult women. The weight fell preponderantly to the left in a comfortable stance. However, the mean location of the center of weight is such that the margins of static security are roughly equal on all sides when the functionless accessory area of support is disregarded. We have also demonstrated that, as Steindler believes, there is an inherent tendency for each individual to maintain his center of gravity at a constant point in relation to his structural supports. The standard procedure for the graphic study of the trajectory of the center of gravity during three minutes of quiet standing in a natural and comfortable stance was followed on different days. The utmost care was exercised to assume the same posture. The involuntary sway of one of our subjects was unusually great. The maximum displacements of her center of gravity forward, back, right and left during a typical three-minute period of standing are projected into the base of support in Fig. 3. The maximal forward sway brings the center of weight dangerously near the fore extremity of the antero-posterior diameter of structural foot support. The subject was forced to grip with the toes to keep from falling forward, even though the center of gravity never moved beyond the heads of the first metatarsals. Backward motion was less great. The remarkable feat is that, in spite of involuntary postural sway of this extraordinary magnitude, the average position of the center of gravity on eight different days was confined to an area of 1.5 sq. cm. in a base of support measuring approximately 500 sq. cm. The data are illustrated in Fig. 3. Six consecutive trials on the same day yielded essentially identical results, the average centers of weight now being still more closely clustered. However capricious the behavior of the center

of gravity may seem during so-called "quiet" standing, its oscillations are so accurately belanced that the average relation of the center of gravity to the base of support remains remarkably constant at least in vigorous, healthy young adults with a good equilibratory and kinesthetic sense.

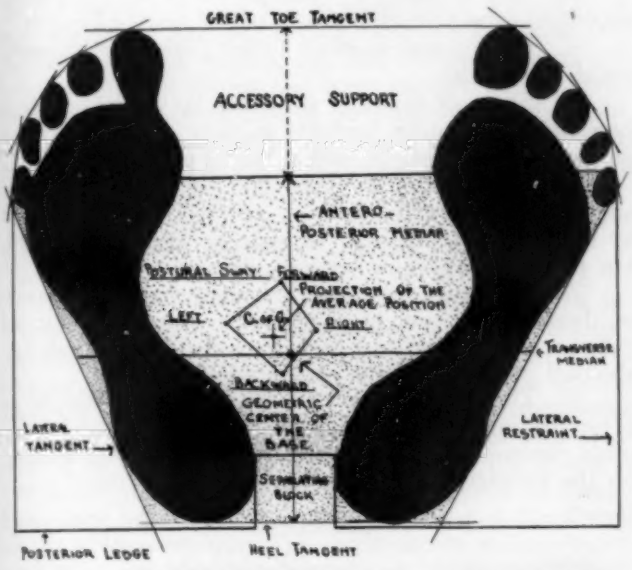

Fig. 2.—Planographic reproduction of the base of support of a normal young adult woman illustrating the slight eccentricity of the average position of the center of weight during three minutes of comfortable standing. The peripheral points FBRL indicate the maximal shift in the center of weight forward, back, right and left. The foot guide is removed before a record is made. If the projected center of weight falls anterior to the transverse median, the AP eccentric value is positive; if it falls posterior to it, it is negative. Similarly, if the projected center of weight falls to the right of the anteroposterior median, the lateral eccentric value is positive; if it falls to the left, the value is negative.

3. *The Effect of Shoes upon the Location of the Center of Weight and upon Postural Stability.* Fifty-one experiments were performed on a homogeneous group of 12 vigorous young adult women, habitually wearing low-heeled shoes. The area of underpropping varied with the heel height of the shoe being worn. The low-heeled shoes provided an average increase of 10.5 per cent in the total supporting area. The base of support furnished by shoes of medium heel height was slightly smaller than that of the bare feet. The highest heeled shoes decreased the contacting foot area on an average by 15.1 per cent.

The subjects responded similarly. In quiet standing without shoes the average position of the center of weight was close to the geometric center of the base of support. When a low-heeled shoe was worn, the center of weight remained in approximately the same position with respect to the new base. Heels of moderate height similarly failed to significantly shift the average location of the center of weight. When shoes with the highest heels to which the subject was accustomed were worn, the projection of the center of gravity into the base of support continued to fall near the geometric center of the area of underpropping in 7 of the 12 subjects. In the remaining 5, the center of weight was thrown forward. The data indicate that the center of gravity when projected vertically, typically occupies a position near the geometric center of the base even when the heels are elevated, raising the center of gravity, and further reducing the already small base of support. To achieve this, the multijointed body must redistribute its parts, thus nullifying the derangement caused by uplifting the heels. This may be accomplished in a variety of ways, the most common being a compensatory flexion of the knees or hyperextension of the lumbo-dorsal spine, the latter conveying the uppor portion of the body backward and thus balancing the forward pitch caused by elevating the heels.

Since the position of the projected center of gravity remained nearly constant when shoes were worn, involuntary postural sway was observed in order to determine the influence upon stability of augmenting the chief mechanical impediments to the orthograde stance, raising the center of gravity and narrowing the base of support. The margins of the area within the base allocated to shifts in the center of weight were found by projecting the maximum oscillations in the coronal and sagittal planes. Low-heeled shoes had little effect on postural stability, the area of sway being in some instances slightly decreased in magnitude in consonance with the enlargement of the base. An augmentation of the involuntary postural sway was evident with moderate elevation of the heels. In all but one subject sway was excessive when shoes of greatest heel height were worn. The degree of pertuberation may be unduly accentuated by the fact that the subjects were unaccustomed to standing in high-heeled shoes, but the tendency to become less steady with each infringement of the security of a body already in unstable

Fig. 3.—A photographic reproduction of the base of support in stance. The central cluster of eight dots represents the projection of the average location of the center of gravity during three minutes of standing in a natural comfortable stance on eight different days. The maximal shift of the center of weight to and fro in the two vertical orientation planes on the day differentiated by the triangular outline of the average spot is represented by the outlying similarly enclosed data.

equilibrium might be deduced on *a priori* grounds. Table II contains a typical set of data illustrating the trend of the results. From its examination it is evident that even though very high-heeled shoes heighten the center of gravity, lessen the base of support and magnify the unintentional postural sway, the greatest area within the pedal foundation to which shifts in the center of weight are apportioned is only a fraction of the total underprop

space. A large margin of safety still remains, affording protective security in all planes.

Table II—Showing the Influence of Shoes With Heels of Various Heights upon the Base of Support, the Location of the Projected Center of Weight and Postural Stability.

Heel Height	Total Base of Support	Eccentricity in the Vertical Orientation Planes		Area of Maximal Sway
		Antero-Posterior	Transverse	
cm.	sq. cm.			sq. cm.
0.0	426.9	+ .129	— .063	4.4
2.5	429.9	+ .098	— .052	3.3
4.0	380.9	+ .027	— .014	5.5
5.2	369.3	.000	— .129	19.1

If the projected center of weight falls anterior to the transverse median or to the right of the antero-posterior median, the eccentric value is positive; if it falls posterior to or to the left of the respective medians, it is negative.

SUMMARY AND CONCLUSIONS

The characteristics of the base of support in stance were studied on young adult women possessing functionally normal feet. The average position of the incessantly shifting center of weight was located within the area of underpropping, and disturbances in static security induced by shoes were measured. From the evidence presented it may be concluded that:

1. The transverse diameter exceeds the antero-posterior diameter of structural support when the feet are separated by a 30-degree wedge, but closely approximates total foot lengths.

2. Irrespective of the magnitude of the involuntary shift in the center of weight which is inseparable from the upright stance, young adults of good equilibratory and kinesthetic sense maintain the *average* location of the center of gravity in a highly constant relation to the structural diameters of the base of support.

3. The average projected center of weight closely approaches the geometric center of the base of support.

4. The margins of static security are approximately equal on all sides.

5. Shoes of low and moderate heel height have a negligible effect upon postural stability and the location of the center of weight within the base of support.

6. Shoes with extremely high heels may either insignificantly effect the location of the center of weight in respect to the base of support or move it forward, but postural sway now becomes excessive.

7. It is suggested that the augmented vascillation of the center of weight is obligatory when high-heeled shoes are worn because they intensify the natural mechanical instability of the orthograde stance.

8. The maximal shifts in the center of weight as projected into the base of support rarely encroach seriously upon the limits of the underprop area, leaving on the average a relatively wide margin of safety.

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Scoliosis

A Functional Decompensation

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Scoliosis may be defined as an abnormal, persistent lateral curvature of the spine with symptoms due to functional decompensation of the back.

The history of scoliosis dates back to the most ancient known civilization. The presence of the lateral curvature of the spine was familiar to the ancient Egyptians. Hippocrates left a description of scoliosis and even suggested a remedy. However, the actual understanding of scoliosis has remained obscure. One of the important steps in the development of present day knowledge occurred at the time of Hessing. Hessing was a mechanical genius who made a form-fitting brace which gave sufficient support to the back so that a patient with scoliosis who wore one of these braces received definite benefit. This was the beginning of the supportive treatment for scoliosis. The opposing school developed under Ling in Stockholm. Ling had the conception of making a perfect body by developmental exercises. The use of the various types of exercises and corrective strengthening received its great impulse from the fact that marked improvement was noted as a result of gymnastic therapy. Later, orthopedic surgeons developed the combination of supportive and corrective treatment. In addition, they have added much to the understanding of the condition both as to its development and as to its etiology.

Before going on to a discussion of the pathologic process of scoliosis, it is essential to define some of the common terms used in describing the condition. The terms primary curve and secondary curve are frequently used; the primary curve is the original curve, and the secondary curve is the compensatory curve. Automatically, one speaks of a right or left curve, depending on the direction of the deviation. The term "structural scoliosis" is sometimes used to describe the presence of abnormalities in the bones and ligaments. If the curve is a single simple curve, it is spoken of as a C curve; if there is a compensatory curve present, it is called an

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S curve. Usually the lateral curvature is associated with torsion of the vertebral column; this is termed rotation. The location in which the curvature occurs is used further to define the scoliosis; for instance, one speaks of right lumbar or left lumbar scoliosis. The changes in the bone and in the soft tissues tend to limit the motion of the spine and to bring about what is clinically known as fixation; it limits one of the functions of the back, that of motion, but aids the more important function of maintaining the erect posture of the body. When the back is capable of carrying out this function, it is said to be sufficient; an insufficiency arises when there is weakness in the structures of the back or when the normal back is overstrained by too great a load.

Morbid Anatomy

The structural changes that occur make up the actual morbid anatomy. The primary structural changes are those which give rise to scoliosis; the secondary structural changes result from the altered statics brought about by the curvature. The bony changes that occur as primary structural changes are congenital malformations of the vertebrae and the destruction of the vertebrae by disease such as tuberculosis, osteomyelitis or tumor. Secondary bony structural changes consist in the altered shapes of the vertebrae. The vertebrae are wedge shaped, with the narrow margin toward the concavity. The articular facets are broader and more horizontally placed than normal. The intervertebral foramina are narrowed; the transverse process on the concave side is narrower than normal, and the vertebral foramen is egg shaped instead of round. The presence of strain and irritation frequently causes overgrowth or exostoses at the vertebral margins; at times these are extensive enough to cause a certain degree of fixation. With the presence of strain there is loss of joint space, particularly at the convex side, between the vertebrae. The intervertebral disks are compressed and become wedge shaped. A certain amount of fibrous change occurs in the disks; the joint surfaces become irregular, and there is loss of cartilage until actual fusion occurs. The ligaments accommodate themselves to the altered position of the spine and are stretched on the convex side and short and thick on the concave side of the curvature.

The changes in the muscles vary with the different types of scoliosis, as, for instance, the muscular changes seen in scoliosis caused by spastic hemiplegia and those associated with scoliosis caused by infantile paralysis. In the latter there is an actual flaccid paralysis which may involve any one group or even individual muscles of the back or abdomen, while in the former there are hypertonic muscles on one side. In the adolescent type of scoliosis the muscles on the convex side are thin and stretched and show fibrous changes while the muscles on the concave side are shortened and may show fatty degeneration. Other anatomic changes that occur concomitant with the lateral curvature are an increased posterior curve in the dorsal area (rounded kyphosis) and an increased anterior curve in the lumbar region (lordosis). Rotation is frequently present, and the effect on the chest is marked. The ribs, which act as long levers attached to the vertebral column, show a marked deformity; the result is compression of the wall of the chest on one side. Frequently this distortion is so marked as to interfere with the normal use of the lung, and at times it compresses the heart or even the aorta and vena cava.

In order to understand the development of the curvature which makes up the scoliosis, a few normal anatomic and physiologic facts should be emphasized. Significant is the fact that there are normally present four anteroposterior curves.[1] The primary curves are a posterior curve in the dorsal area and a posterior curve in the sacral area. The anterior curves in the lumbar and cervical areas develop after the child assumes an upright position, and these are therefore considered compensatory or secondary curves. One lateral curve is normally present in the dorsal area; this is usually to the right, although it may be to the left, the variations being dependent on race, occupation and other factors.

Of physiologic importance is the fact that the primary function of the back is to hold the upright position;[2] furthermore, the human body will always attempt to assume the upright position. Movement in the dorsal area is relatively limited, 80 per cent of the motion of the spine being in the lumbar area. In addition, one must remember that structures will grow, within limits, according to the demand made on them. It is not difficult to understand the development of a lateral curvature secondary to a tilt in the pelvis; the lateral curvature is compensatory in order for the body to retain the upright position. Similarly, there is a compensatory dorsal lateral curvature in the presence of torticollis. Relatively easy to understand, also, is the lateral curvature of the spine caused by the contracture of the pleural cavity. That spastic paralysis of one side would cause some degree of lateral curvature is to be expected. The imbalance in weight bearing caused by a laterally wedge-shaped vertebra, whether due to a congenital anomaly or to destruction by disease, gives rise to scoliosis. The explanation of the curvature in anterior poliomyelitis is more involved. It is readily seen that a curvature will develop when the muscles on only one side of the back are paralyzed; however, there are scoliotic curves which develop when parlysis in the muscles is relatively symmetrical. The development of the curves in these cases may be explained on the same basis as those in the so-called adolescent type of scoliosis.

Rachitic scoliosis is due to a softening of the structures, particularly the bony structures in the vertebrae; hence, when normal stress is applied there is a tendency for an increase of the normal lateral curvature with the development of compensatory curves. The severity of the curvature is dependent on the degree of weakness caused by the rickets as well as on the amount of stress applied.

Adolescent scoliosis is so called from the period at which it most frequently occurs, but like rachitic scoliosis, it is due to a weakness in structure. The primary weakness is in the muscles,[3] although the ligaments and bones show some loss of strength. If there is an imbalance between the capacity of the back to do its normal work and the demand made on the back there will ultimately be an increase in all the normal curves; therefore, the first physical sign is usually an increase of the anteroposterior curves, which is recognized as poor posture. If the imbalance continues, the lateral curvature will also increase and scoliosis will develop; ultimately there will be compensatory curves to the dorsal curve in the lumbar and cervical areas. Therefore, scoliosis develops whenever there is a decrease in strength of the structures of the back (loss of capacity) or if there is an increase in the demand made on the back (overload), or a combination of the two. In the presence of such a condition, decompensation develops; the word insufficiency is sometimes used for decompensation. The decompensation refers to an imbalance in the function and

gives rise to symptoms of fatigue and strain. A prolonged period of decompensation will result in an increase in all the normal curves, which means a lateral curvature; this condition is called scoliosis. With the occurrence of lateral and anteroposterior curvatures, the effect on the vertebral column must be torsion or rotation. The greater the decompensation and the more prolonged the duration of the scoliosis, the more severe the curvature will be and the more marked the actual structural changes.

ETIOLOGY

The various clinical forms of scoliosis are best classified on the basis of etiology. There are, first of all, two distinct types—congenital and acquired.

The congenital scolioses are of one of two types. 1. The first type is due to an anomaly. There is a definite deformity which can be demonstrated roentgenographically; the lateral side of one or of several vertebrae is only partially formed, or one or more vertebrae may be absent, resulting in a relatively sharp lateral curvature in the direction opposite the involved side. In cases of severe involvement there will be a compensatory curve above and below this primary curvature. In many instances, however, the structure, even though badly formed, will be highly efficient, and there will be no decompensation. In such cases the deformity is the only abnormality, and the prognosis for any change in the deformity is practically nil; on the other hand, no symptoms in the way of impaired function will develop. 2. The second type of congenital scoliosis is probably due to the prolonged retention of the lateral posture in utero; in this type there is the simple C curve. The roentgenographic picture is normal; the curvature, however, tends to persist, particularly when the body assumes the upright position; the spine is pliable. With corrective measures the prognosis for full recovery, both anatomically and functionally, is excellent.

Acquired scoliosis may be divided as into the following types:

Curvature Due to Rickets of Osteomalacia.—The existence of fetal rickets and its relationship to scoliosis is still problematic. The occurrence of static deformities and the presence of rickets are well known. Owing to softness and weakness in the structures of the back, there is an increase of all the normal curves; so there may be rachitic kyphosis as well as the rachitic scoliosis. The roentgenogram shows changes in the bone. The presence of the other signs of rickets helps to establish the diagnosis. Usually rachitic scoliosis is severe. The prognosis is dependent on the early recognition of the condition. If a highly developed curve has been allowed to persist until the child has reached adolescence, little can be done in the way of correction of the deformity. The prognosis as to function, however, is relatively good.

Scoliosis due to osteomalacia may be explained in the same manner. The condition, fortunately, is rare; the prognosis is poor.

Scoliosis Due to Flaccid Paralysis (Anterior Poliomyelitis).—Scoliosis due to infantile paralysis presents the most bizarre forms. This is to be expected in view of the various muscles affected, as well as the varying degrees of paralysis present in each muscle. A marked asymmetrical paralysis will definitely affect the degree of the curvature. The most severe types of scoliosis seen occur as the result of infantile paralysis; one sees not only the highest degree of deformity but, owing to the paralysis, marked incapacity. In connection with poliomyelitis, it has been observed that paralysis of the abdominal muscles will give rise to a scoliotic curvature. The explanation offered is that it is impossible for the muscles of the back to act, as the function of the abdominal muscles, which act as opponents, is completely lost. The inability of the muscles to act results in a loss of normal function of the back, namely, to hold the erect position; the result is an increase of the curvatures, including the lateral curvature, and, therefore, scoliosis. The prognosis in these cases is dependent on the amount of recovery possible in the nerves and, ultimately, in the muscles. The early paralysis, owing to edema, will, if properly cared for, permit recovery in strength. The prognosis, therefore, depends on adequate treatment in the early stages and on the development of power in the remaining muscles. If the paralysis is so severe that even with proper treatment there is insufficient strength to hold the upright position, scoliosis will inevitably result. The severity of the scoliosis and the amount of disability can be controlled, to some extent, by supportive measures. In this connection it is important to realize that there is a natural tendency in the body to create a fixation which will increase the stability as well as the capacity of the back. The curvature ultimately reaches a point where it becomes fixed and acquires a certain degree of compensation so far as function is concerned, so that with limited functional demands the patient may be relatively free from symptoms in spite of a deformity. Of course, with the severe deformities there are decrease of vital capacity and impairment of cardiac function, which means a shortening of life expectancy.

Scoliosis Associated with Syringomyelia.—It is estimated that 80 per cent of all persons with syringomyelia have an associated scoliosis; in fact, it is one of the first symptoms to appear. The curvature is usually higher than in other types of scoliosis; characteristic also is the fact that it is slow in acquiring fixation; in other words, it remains mobile for a long time. The severity of the condition varies. In late stages kyphosis and deformity of the chest develop. The cause of the scoliosis is not certain. It is believed that it is due to trophic disturbances in the bone. The pathologic process is a spastic paralysis with dissociation of sensation—retention of touch and loss of heat and pain senses. Among the trophic changes are swelling in the hands, thickening of the skin and arthropathies. The lesion is in the spinal canal and may be a gliosis, a tubelike cavity or a degenerative change in other parts of the cord due to pressure. The primary condition is usually progressive, which, of course, determines the prognosis.

Curvature Due to Spastic Palsy (Hemiplegia).—When spastic paralysis involves one side of the body, a lateral curvature develops in an effort to establish a balance; this is, to a certain extent, a compensatory curvature. The prognosis is dependent on the possibility of clearing up the spastic paralysis. This type of scoliosis does not give rise to a functional disturbance.

Scoliosis Secondary to Deformities Elsewhere in the Body (Static Deformity).—Any deformity that causes a pelvic tilt, such as an anomaly in the development of the pelvis or shortening of one limb as a result of anterior poliomyelitis, tuberculosis, fracture, epiphysial slipping, contractures of the hip and knee, dislocations of the hip or unilateral genu valgum, will give rise to a lateral curvature in the lumbar area; compensatory curves may develop, giving rise to an S-shaped scoliosis. The curve develops in compensation for the malposition of the pelvis and is the result of correction, to enable the body to hold the erect position. The prognosis is dependent on the

possibility of correcting the pelvic tilt. The condition usually is not progressive.

Scoliosis Due to Torticollis.—The presence of torticollis, whether congenital or acquired, gives rise to a secondary compensatory curve in the dorsal area. A one-sided cervical rib would have the same effect. This type of scoliosis may also develop secondary to a congenital elevation of the shoulder. The prognosis in these cases is dependent on the possibility of correcting the primary deformity.

Curvature Due to Local Disease of the Spine.—Any lesion that destroys the lateral part of one or of several vertebrae will result in an angular type of scoliosis in that area; secondary curvatures will develop later. Tuberculosis occasionally causes such a destruction. At times one sees the same type of scoliosis as a result of a malignant condition. Rarely, a fracture of the vertebral body will give rise to a lateral curvature. The scoliosis in such cases is of relatively minor importance in comparison with the primary disease.

Curvature Secondary to Contracture of the Chest.—A contracture in the wall of the chest, whether due to pleurisy or thoracoplasty, will result in a lateral curvature in the dorsal area. Rotation occurs early in this type of scoliosis. The ribs exert an influence on the spine so as to cause rotation and lateral curvature. The prognosis is good so far as the arrest of the progress of the deformity is concerned.

Lateral Curvature Due to Sacro-Iliac Disease or Sciatica.—In reality such a curvature is a protective list and not true scoliosis. The curvature or list will subside if the pain is relieved.

Hysterical Scoliosis.—This type of scoliosis occasionally occurs in women and, in rare instances, was seen in men during the World War. Usually other signs of nervous irritability are present. Of diagnostic value is the fact that the scoliosis disappears under anesthesia.

Adolescent Scoliosis.—This type of scoliosis has also been called idiopathic, static, occupational, habitual, postural or simple scoliosis. The term "idiopathic" should be eliminated as obsolete, as the etiology no longer remains unknown. The scoliosis develops secondary to a functional insufficiency of the back. Anything that decreases the normal capacity of the back or increases the load beyond normal, or a combination of these factors, will tend to give rise to an adolescent scoliosis. One of the principal factors that decrease the normal strength of the back is the rapid growth that occurs during the period of adolescence. Debilitating diseases lower the strength of the back, which accounts for the scoliosis which occurs after scarlet fever. In children physically below par, if they are not guarded, scoliosis slowly develops. This failure of sufficient structural development may be due to the lack of proper food. Insufficient air and sunshine will act as additional factors; inadequate physical exercise is an important factor. The introverted child with studious tendencies and poor muscular coordination is prone to lateral curvatures of the spine. The load may be increased unilaterally by the carrying of heavy books on one arm. Most important, however, is the abuse of the primary function of the back, namely, the holding of the erect position of the body. If this function is unduly prolonged, a strain will result. Formerly this was a frequent occurrence among school children. At times the load may be increased by excessive body weight. Usually it is a combination of several of these factors over a relatively prolonged period of time that accounts for the development of scoliosis during adolescence. It is possible that rickets may also play a rôle, particularly the so-called "late rickets." Unrecognized congenital malformations, particularly in the fifth vertebra, may play a more important part than is realized in the development of scoliosis during adolescence. In this country adolescent scoliosis occurs more frequently than all the other types combined. This is not true in European countries where scoliosis due to rickets occurs more frequently than the other types. It is difficult to say just when the adolescent scoliosis develops. Children usually are brought in for attention during the school age; the average age seems to be about 13 years. It is evident that the curvature arises some time previous to the time of examination.

With regard to symptoms, in the incipient stage adolescent scoliosis is a simple C curve in the dorsal area. Right dorsal and left lumbar curves occur in about 80 per cent of the cases; in the other 20 per cent the curves are inverted, that is, left dorsal and right lumbar curves. Rotation appears by the time the posterior curves develop. In the dorsal area the ribs emphasize the rotation, and the deformity of the chest is marked, while in the lumbar region the transverse processes are comparatively short, and the rotation, although equally great, is not apparent. In the usual form of scoliosis the left shoulder drops lower than the right; the right scapula projects posteriorly and is high; the left wall of the chest is compressed posteriorly, with the ribs curved downward. The vital capacity is diminished; the shoulders droop forward, and the normal lumbar curve is accentuated. The torso seems to be shortened, and the body tends to list toward the affected side. The patient usually complains of fatigue and backache. These are the chief symptoms of muscular insufficiency of the back. In cases of extreme involvement the nerve is impinged, causing severe pain along its distribution. There is inability to carry out normal exercises. Frequently there is an associated awkwardness; many of the children are extremely sensitive and shy and have an inferiority complex.

The curvature usually grows progressively worse if left untreated, provided the causative factors continue to exist. In many instances the causative factors are removed without actual recognition of their importance. Complete recovery may result. Even when a curvature has developed, the condition in some cases is arrested simply by means of participation in athletic sports; on the other hand, strenuous athletics may increase the deformity.

The principal complications have already been indicated under symptoms—cardiac decompensation, decrease of vital capacity and altered psychology.

The prognosis in cases in which treatment has been given is variable, depending on the extent and severity of the scoliosis. In extreme scoliosis of long standing it is impossible to obtain complete correction of the deformity; in the early stages satisfactory correction and retention of normal position can be accomplished. The best prognosis is held in those cases in which the first signs of the lateral curvature are recognized and prophylactic treatment is immediately instituted. In the cases of severe involvement, even though the deformity cannot be corrected, the functional capacity can be greatly increased.

TREATMENT

The object of treatment in scoliosis is twofold: the reestablishment of normal function and the correction of the deformity.

In reviewing the methods of treatment, only those which offer some definite principle are included. With the introduction of the form-fitting corset by Hessing,

supportive treatment was first used to give relief from the strain and to bring about some correction. These corsets were of several types. They were applied with the body extended, with reenforcements beneath the convexity; counterpressure was applied to the sacrum. The principle involved in the Hessing corset is used in modern treatment.

The principle of exercise in various forms has been recommended, for example, passive exercise, in which force is directed against the convexity, and active exercise; the latter has been found the more satisfactory. Various systems have been devised; however, more important than the particular system used is the fact that the exercises are graduated to the needs of the patient. Exercises to increase the strength of the muscles only on the side of the convexity were used for many years. Some even went so far as to attempt to reduce the strength on the concave side. It was found that all exercises that increased the strength of the muscles, whether the muscles of the abdomen, back or shoulder or of the pelvic girdle, were beneficial in the treatment of scoliosis. Greater mobility is possible with the body in the horizontal position, and exercises on the hands and knees were prescribed. By the same token, swimming can be considered a beneficial exercise, particularly as an early exercise for weakened muscles. Corrective exercises in which the patient voluntarily stretched the body by means of a Sayre attachment to the head have been used. Many types of apparatus consisting of mechanical levers to increase the force have been invented. Some of these have been combined with mechanisms for extension.

Correction by means of hyperextension frames and by plaster of paris beds, in which the body was held in a corrected position, has been attempted. The disadvantage of prolonged hospitalization and rest in bed is the resultant increase in structural weakness.

Treatment by means of forceful correction, with retention of the corrected position by means of a plaster of paris cast, has been tried. Abbott developed this type of treatment to a high degree. However, the severity of the pain, the development of pressure sores and the inability to increase the strength during treatment ultimately made it necessary to abandon this form of correction.

Derotation is another fundamental principle in the correction of the scoliotic deformity. This has been attempted by means of elastic straps passing over the shoulder and down around the pelvis and acting as a derotating coil. Another method fixes the chest in a vice; the pelvis is fixed on a seat that can be tilted and rotated; with the upper part of the body fixed, the pelvis can then be turned to bring about a derotation. When the desired position is attained, the chest, the trunk and the pelvis are held with a plaster of paris cast. Correction can be obtained in this manner, but again it is difficult to reestablish the capacity to retain correction. A more simple method to obtain the same result is to fix the pelvis by means of a horizontal bar on an upright frame and to derotate by turning the shoulder girdle, using the arms as levers.

The treatment of scoliosis is dependent on the etiologic factors. In congenital scoliosis the presence of an anomaly does not permit the actual removal of the causative factor. Attempts have been made to remove the hemivertebra in order to balance the spinal column. Surgical removal can actually be carried out, but the improvement obtained does not justify the procedure. Furthermore, it is questionable whether the capacity is not decreased rather than increased. The most important part of treatment is to prevent a further increase of the curvature. This is best accomplished by the use of functional exercise, that is, by treating the child as though it were normal. In other words, the use of braces, unless there is an additional factor, is contraindicated.

Congenital scoliosis due to intra-uterine posture can be corrected even before the child is able to sit up. If the deformity tends to persist, it may be advisable to use a plaster of paris bed with the curvature in the opposite direction. The child can sleep in such a bed, and correction is attained. Furthermore, the parents can hold the child in such a way that there is a tendency for the deformity to be corrected. If the curvature is not recognized until the child begins to walk, it is occasionally necessary to apply a plaster of paris jacket, with the child held in the overcorrected position. Once such a jacket is applied, it is important to make certain that exercises are carried out to keep up the general strength of the body. The more rapidly this correction can be attained and all supportive treatment discontinued, the better the result.

In the treatment of scoliosis due to rickets, the problem is twofold. In active rickets the process of deformity is progressive. During this period correction can be attained; this can be done by means of casts and braces. However, of primary importance is the treatment of the rickets itself; this, of course, includes a complete antirachitic regimen. The earlier this is instituted the more satisfactory the result. The scoliotic deformity may progress after the actual rickets has subsided; this deformity is fixed. Only in the preadolescent stage is there hope for improvement so far as correction of the curvature is concerned. Of prime significance, therefore, is the attainment of the maximum amount of function. When this is accomplished, even though the deformity may persist, the child will be able to lead a normal, useful life.

Scoliosis due to anterior poliomyelitis offers the most difficult phase of the scoliotic problem. The final solution of the problem must be the prevention of infantile paralysis. The early recognition of the involvement of muscles of the abdomen and back in cases of poliomyelitis and the protection of such muscles until they regain the maximum amount of strength are of primary importance. In the reestablishment of strength, exercises are essential; under-water therapy and swimming are important. The back must be protected against the development of a curvature. In this connection, the patient should be permitted to sit or stand for only a brief period; as the strength of the muscles increases, the length of time may be gradually increased. The use of massage and muscle training is essential, as in any case of paralysis. In those cases in which in spite of the best treatment (protection and exercise) there is insufficient strength, a support is necessary. The extent of the paralysis and the weight of the patient determine the type of support to be used. Form-fitting supports are preferable; one may use a jacket of leather and steel or of celluloid, or a corset made of cloth reenforced with stays. With time there is a tendency for fixation of the curvature; this may ultimately be sufficient to permit the patient to discard the support. To hasten the fixation, the fusion operation is of benefit. If the back has not been protected and the curvature is exaggerated, some correction may be taken before the fusion operation is performed; either a Hibbs or an Albee operation may be done, or a graft may be placed in the convexity to act as a supportive column or prop.

The treatment of scoliosis associated with syringomyelia must be directed against the disease itself. Lami-

nectomy with drainage of the cavity fluid has been done, although the use of anesthesia in such cases is dangerous; cervical puncture, exposure of the spinal column to the roentgen rays and the use of mercury and iodides have been tried.

In spastic palsy, treatment of the scoliosis is dependent on the improvement of the hemiplegia and may include correction of the equinus deformity.

In scoliosis due to a deformity elsewhere in the body, for instance a pelvic tilt, correction of the curvature must be directed against the pathologic process which causes the pelvic tilt. If this is a tuberculous hip, the adduction and flexion deformity must be corrected. Frequently a slight raising of the shortened limb will be followed by improvement.

Scoliosis in the dorsal area found in torticollis subsides with correction of the torticollis. If a cast is applied to hold the correction of the head and neck, it may also include an overcorrection of the dorsal area.

For scoliosis due to a destructive lesion of the vertebrae, the treatment is limited to treatment of the lesion itself.

Scoliosis which develops secondary to pleurisy or thoracoplasty cannot be completely corrected, but some improvement is obtained by exercises, particularly deep breathing and the holding of the erect position of the body.

The protective list secondary to sciatica and sacroiliac disease disappears spontaneously with relief of the primary condition.

The treatment of adolescent scoliosis consists of (1) prophylaxis, (2) correction of the deformity and (3) reestablishment of normal function. Prophylactic treatment necessitates early recognition of an abnormal lateral curvature. Suggestive is the history of fatigue and bad posture in a rapidly growing child. The disrobed child is examined for any increase in the normal curvatures of the vertebral column and the presence of a pelvic tilt. All causative factors are investigated and, whenever possible, eliminated. Strain is relieved by periodic rests; strength is increased by graduated exercises; food deficiencies are replenished by a high caloric diet and, at times, with feeding at intervals. Secondary anemia is treated with iron and liver extract; vitamins are supplied in ample doses, and calcium is added to the diet. The child is encouraged to take part in outdoor activities which include fresh air and sunshine.

If a scoliotic deformity is already present, the curvature must be corrected. The method of correction used is based on the teaching of Professor Haglund.[4] The pelvis is leveled. The dorsal curve is relatively fixed, while the lumbar curve is freely movable and readily corrected. Therefore, in the presence of a right dorsal curvature, if the trunk of the body is made to list to the left, the left lumbar lateral curve is obliterated. In a similar manner, in the presence of kyphosis in the dorsal area the compensatory lumbar lordosis is obliterated by tilting the body forward. Derotation is obtained by fixing the pelvis and rotating the shoulder girdle in the opposite direction, with the arms acting as levers. In this position, if the pelvis is fixed with a plaster of paris jacket which incloses the lumbar area and extends up to the dorsal curve, correction will follow. The body will assume the upright position due to the body-righting reflex. The result will be a correction above the cast in the region of the right dorsal curvature. This correction is controlled by natural forces.

In addition to correcting the deformity, the cast also acts as a support to relieve the functional decompensation. At the same time it permits normal use of the body structures. The patient can pull himself out of the cast and can go on with practically all normal activities. The treatment is entirely ambulatory, permitting the child to go to school.

In early stages full correction can be obtained by this method. To retain the correction it is necessary to reestablish the normal capacity of the back. To do this, after the cast has been removed the normal position is held by means of a support, which may be either a steel and leather jacket or a reenforced cloth corset, until the structures have been developed by exercises. The exercises used are graduated physiologic exercises, that is, the carrying out of the normal functions of the back, so that ultimately there is sufficient fixation to give full compensation, which will prevent a recurrence of the deformity.

In cases of severe involvement of long standing, with fixation, it is not possible to obtain complete correction. If the back is compensated, even though the deformity is marked, it is best not to attempt correction, as in breaking down the fixation there is danger of bringing about a decompensation. However, if the patient suffers from pain due to pressure on the nerve, then in spite of the fixation it is necessary to take sufficient correction by the foregoing method to relieve the symptoms.

In order to obtain fixation more rapidly, a fusion operation may be performed. A fusion operation in itself obviously cannot correct the scoliosis. The method most frequently used is the forceful correction by means of turn-buckle casts, followed by a fusion with bone grafts. It has been found that in those cases in which compensation and fixation were obtained after fusion operation, the correction was retained; however, if the decompensation persisted in spite of the bone graft, the deformity continued to increase (Steindler).[5]

The problem of scoliosis is not solved, but with a better understanding of the condition the ultimate outlook for the prevention of a deforming scoliosis is good. This is particularly true of the adolescent type of scoliosis. The answer in the other types of scoliosis lies in the prevention of the disease causing the curvature.

Summary

A new conception of scoliosis is presented. Scoliosis is due, not to an imbalance in the pull of the muscles of the back, as is commonly believed, but to an increase of the normal curvatures of the back. This increase of the normal right dorsal lateral curvature is brought about by a decompensation in the functional capacity of the back. The development of the structural changes is explained. The etiology of adolescent scoliosis is given for the first time and utilized to prescribe prophylactic measures. In addition, a new type of corrective treatment is described. Not only is the deformity improved, but all the secondary disturbances in function are relieved. This method of treatment has been applied successfully over a period of ten years. Owing to the prevalent confusion as to the conception of scoliosis, it was necessary to treat the general consideration of the subject with thoroughness.

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Device for Moving Patient from Bed to Underwater Exercise Tank

Helen S. Hartigan, R.N.

Because of the great difficulty encountered when moving some of our heavier patients into their treatment tanks, it became necessary to devise an inexpensive piece of apparatus to help us. The stretcher which is described in this article was designed by and constructed under the supervision of the mother of an adult patient. By this means, it is possible for one operator to move a patient from his bed to the tank and back again, a task which formerly necessitated the combined efforts of three people. The tank size is 72"x48"x18", constructed as previously described.[1]

The stretcher is rectangular in shape, eighteen inches wide and slightly shorter in length than the tank in which it is used. The frame is made of hard wood 2"x1½" and is bolted together with carriage bolts. Sailcloth, perforated to allow rapid drainage, is stretched across the frame. One end of the frame is fitted with steel hooks to fasten the stretcher to the head of the tank. The hooks were made by a blacksmith and are shaped to hold the stretcher on the same level as the edge of the tank. The other end is supported by two legs joined together with a cross bar.

The legs are the same length as the depth of the tank. They are bolted onto the inside of the frame with a washer (preferably of rust-proof material) between. This allows the legs to be moved as on a hinge. When their support is not needed they fold up under the frame. The bottom of each leg is equipped with a steel button. This facilitates moving the loaded stretcher across the tank. Above the steel button a hole has been drilled through each leg. The ends of a two-yard piece of rope are secured in these holes.

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The stretcher is adjusted in the tank close to the edge with the hooks fastened to the head of the tank, the legs upright. To move a patient into the tank the bed or cart is moved to the side of the tank. The patient is then rolled over onto the stretcher and grasps the loop of rope which is secured to the legs of the stretcher. When the operator raises the lower end of the stretcher, the patient pulls the rope thus folding the legs under the frame and allowing the lower end to sink into the tank. The operator then unhooks the upper end from the head of the tank and lowers it into the water. The stretcher may be floated from under the patient and removed from the tank or rested against the side.

During the treatment the patient's head is supported in a hammock or on an inclined head rest.

To remove the patient from the water, the stretcher is floated under the patient. The head of the frame is raised by the operator and hooked onto the tank. At the lower end the rope is allowed to hang over the edge of the tank. The operator places her foot in the loop of rope and, after raising the stretcher with her hands, pushes down with her foot, drawing the legs of the stretcher into an upright position.

The patient may be dried on the stretcher and then rolled on to the bed.

The idea of this collapsible stretcher has been used with various modifications for other patients. Its value lies in the simplicity of construction, ease of operation and inexpensiveness.

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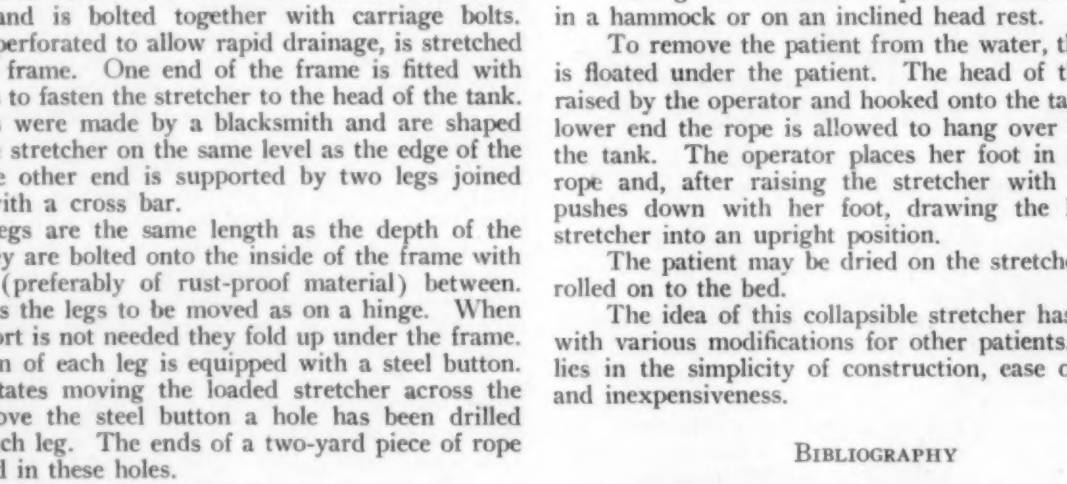

Section of tank showing stretcher in place. Insert: Under side of stretcher, legs collapsed.

Speech Training at Dowling School for Crippled Children

Berneice R. Rutherford

Two phases of speech work are carried on at Dowling: Correction of speech defects and dramatics. Dramatics is a new departure. It is one of the extra curricular activities and has no place as yet in the regular program. It is designed to fill a need for expression manifested by many of these children. The aim has not been for finished performances for an audience. In fact, only one public appearance has been made and that was a simple pantomime. If these children can be helped to attain good enunciation, meet situations with poise, and be happy in the effort, the goal for dramatics at Dowling has been reached.

Speech defects at Dowling range all the way from a slight dyslalia (due to organic or functional defects of articulation) through severe dysarthria and anarthria (articulation defects due to lesion in the central nervous system); and from slight through severe dysphemia (stuttering).

Physical disability types represented in speech corrective classes include spastics, poliomyelitis, encephalitis, cardiacs, fractures, amputations, congenital deformities, osteomyelitis, and progressive muscular dystrophy. Stuttering and articulation defects are not confined to any one type of physical disability. Physicaltherapy, corrective physical education and occupational therapy are carried on in these specific departments recommended by the school physician.

Therapy used for correction of speech defects includes mental hygiene, auditory stimulation, visual stimulation, kinesthetic stimulation, relaxation, writing-talking activities, voluntary stuttering, "stop and go," and such activities as will further skilled use of the dominant side.

Dr. Bryngelson has so adequately covered mental hygiene that there is little to add except as it is applied at Dowling. Mental hygiene therapy is a very necessary one. But it must be used judiciously with little children. To handle it skillfully a clinician must know herself and each child in her charge. She must be both tolerant and intolerant, and constantly alert to situations. So much mental hygiene is in attitudes and actions. But neither the preaching nor pedagogical type of administration of mental hygiene are recommended. Sometimes the clinician does most of the talking; and as frequently she must be the understanding listener. It is very gratifying to hear someone say of a speech case, "How different John's attitude is now compared to what it was at his entrance to school. He is so much better adjusted." Then there is a realization that mental hygiene therapy is having the desired effect.

Auditory, visual and kinesthetic stimulation frequently are carried on practically simultaneously. The theory back of auditory stimulation is this: Speech is a learned process. What all hearing children *actually hear* is what they give forth as speech. Observe that it is what they *actually hear*. There is a variation in the frequency of sound waves. Higher frequencies are harder to pick up; "s" is a high frequency sound. Incidentally, there are more "s" lisps among children than any other articulation substitution. The ability to hear the sounds does not depend necessarily upon ability to hear well. There may be or may not be some hearing loss. It does not necessarily depend upon concentration of attention. It does depend upon the ability of the hearing apparatus to quickly pick up the sounds as they are and to conduct them to the speech center accurately. In other words, discrimination of sound patterns is the keynote. To produce an accurate sound automatically necessitates an accurate pattern in the speech center in the brain plus ability of the speech muscles and their ennervating nerves to respond in required coordinations. Auditory stimulation is designed to take care of the brain pattern; and visual and kinesthetic stimulation to take care of the response. To aid in getting this pattern accurate the defective or missing sound is given directly into the dominant ear in a manner that eliminates confusion. If the sound is "s," groups of five to ten words with "s" sound in only one position in the word are used: as see, say, so, etc., or the same word may be repeated as: say, say, say. A response is requested only so that the speech clinician will know whether the pattern is correctly formed. An elaboration of this method may be found in Dr. Travis' book "Speech Pathology" (Appleton Co., 1931).

Visual and kinesthetic stimulation assist in clearing articulation defects. Tongue, lip, throat and jaw exercises make and keep these muscles of speech limber and ready for reception of the current. The speech of quite a number of Dowling children are classified as anarthric (no speech due to lesion in the central nervous system). They have little or no ability to move these speech muscles. So tongue blades and applicators are used to make them see and feel positions and to stimulate the nerves and muscles to desired activity. Gentle rubbing of the tongue, throat and jaws seems to promote ability to use these muscles. Where there is no disability in movement of the speech muscles, tongue exercises are given apart from any application to sounds, and auditory stimulation takes care of the pattern formation. This is true in dyslalia particularly.

Relaxation is so much a part of your own treatment that it needs no explanation as to nature. Its importance in all of this therapy is so thoroughly recognized that great space need not be devoted to it here. Active, passive and progressive relaxation (the last based upon the plan of Dr. Edmund Jacobson of Michael Reese Hospital, Chicago) all find a definite place upon the speech program. If the child's speech class can follow a rest period or quiet lamp treatment, the speech work is apt to be more effective. Relaxation generally precedes speech exercises and should be frequent during a long or arduous period. It is very definitely a part of all speech therapy.

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In the Minneapolis public school speech classes, the theory of cerebral dominance as advanced by Dr. Samuel T. Orton of New York Neurological Institute and further applied to speech by Dr. Lee E. Travis of Iowa and Dr. Bryng Bryngelson of Minnesota has been one of the principal bases of speech therapy, especially for dysphemia or stuttering. This theory holds that stuttering is due to "a certain lack of maturation of the central nervous system which results either in malintegration of the highest neurophysiological levels involved in speech or the predisposition of these levels to disintegrate when exposed to certain stimuli." ("Speech Pathology," by Travis, page 255.) Success in arresting dysphemia in a good number of cases with the application of this theory has led to its continued use. Since some of the cases at Dowling are different from cases in other schools only in the matter of ease of walking, this theory was also applied to speech defects in cases of amputations, congenital deformities and so on. Further, it seemed reasonable to believe that if this theory were applicable to normal physical children, surely it would be more applicable in cases where there is a demonstrated lesion as in spastics. So a careful study has been made of results of a lack of unilateral cerebral dominances upon speech.

The following cases illustrate the results of unification of motor leads and establishment of a margin of neurological dominance. Not only stuttering speech, but many articulation cases could well be studied from the standpoint of laterality. Rutherford's study of four cases of dysarthria in the May-June 1937 issue of *The Physiotherapy Review* is on this point.

CASE 1.

Physical Diagnosis: Right Hemiplegia.
Speech Diagnosis: Dysarthia—Medium.
Dysphemia—(When right hand was treated).
C.A. 1/1/37 8 yrs. 1 mo.
Sex: Female.
Birth History: Full term; instrument delivery; injury to right side of head.
Developmental History: Bottle fed for 1 yr. No convulsions or rickets. No thumb-sucking nor enuresis. Began walking about 2 yrs. of age. Talked at 2 years. Articulatory defects began with speech. Stutter showed up intermittently up to 7 yrs. of age. She is the 5th of six children.
Family History: Mother is ambidextrous. One brother is left handed and stuttered when shifted to the right side; one brother had a reading and spelling disability; one brother had an articulatory defect. A sister also had a reading disability.
School History: Entered at 5½ yrs. of age. Good adaptation. Psychological findings (9/11/33) M.A. 5-0. I.Q. 103. Repeated 1A.
Laterality History: Right side crippled. Uses left hand. Is L.E. (1934-35-36-37).
Physical Treatment: Had physical treatment outside of school from 2 to 5 yrs. of age. Had coordination and corrective walking. Brace on right hand for short periods.
Speech Therapy: Tongue, lip and jaw exercises. Auditory and visual stimulation.
Results: Child stuttered before entrance to school during periods of work on right hand. Stutter noticed in school first year near the beginning of the child's first full year in school. The next year much work was done on the right side and she developed severe nervous reactions, with an increase in the stutter. Extra periods of hand activity were given for the left in an effort to counteract the necessary treatment on the right. Both stutter and nervousness diminished in severity, but not until all right hand treatment was suspended did the stutter disappear. Work on the right side is continued now, but as assistance to the left, with no return of the stutter. The articulatory defect has been corrected.

CASE 2.

Physical Diagnosis: Right Hemiplegia.
Speech Diagnosis: Dyslalia—Medium.
C.A. 1/1/37 9 yrs. 5 mo.
Sex: Female.
Birth History: Ether and olive oil enema brought child after 12 hrs. labor; then she was held back, before rapid birth.
Developmental History: Difficult feeding. Given oxygen because breathing was so weak. Walked at 2 yrs., talked at 3 yrs. Had difficulty in swallowing until 4 yrs. old. Stuttered and was very irritable when she had exercises on right side at 4½ yrs. of age. Dyslalia was present at 3 yrs. Is older of two girls.
Family History: Sister is ambidextrous and has an articulatory defect; paternal grandfather is ambidextrous. One paternal male first cousin has an articulatory defect. Twins in maternal family.
School History: Entered school at 5 yrs. 2 mo., good adaptation. Psychological findings M.A. 6-6, I.Q. 109 (9/20/32). Retest: 6/4/33 M.A. 5-10; I.Q. 99.
Laterality History: Left-eyed 1932-36. Uses left hand because right is too disabled to use.
Physical Treatment: All emphasis upon right side.
Speech Therapy: Some tongue, lip and jaw exercises, visual and auditory stimulation on left side.
Results: Dyslalia was cleared in 28 lessons. Has not been in speech class for two years. Speech is good to date. Broke right arm at 9 yrs. In cast for several weeks. No return of stutter.

CASE 3.

Physical Diagnosis: Right Hemiplegia.
Speech Diagnosis: Dysphemia—Mild.
C.A. 1/1/37 7 yrs. 7 mo.
Sex: Male.
Birth History: Full term pregnancy, rapid birth.
Developmental History: Breast and bottle fed for about 9 mo. No convulsions or rickets. Measles and whooping cough at 3 yrs., chickenpox at 5 yrs. Walked at 14 mo., talked at about 1 yr. Cessation of speech for about 1 yr. when good side (left) was tied up. Onset of stuttering was about 2½ yrs., at the time physical therapy on the right hand was begun. Since entering first grade the stutter is more severe. Child is a behavior problem.
School History: Entered at 5 yrs. Psychological findings 9/10/34 M.A. 5-2; I.Q. 96. Adaptation fair to poor. Is a behavior problem. Reading disability. Concentration fair to poor.
Laterality History: Uses left hand; right hand is spastic. Was left eyed (1935-36) Amphiocular (1937).
Physical Treatment, Speech Therapy, Results: When emphasis of physical treatment was on the right side, excessive nervousness was observed with increase in stutter. With concentration on the left side, improvement was noticed in 1 mo. An increase in stutter followed a two weeks' vacation from school. As far as possible the left side was emphasized, although he received general coordination, walking and tank on both sides. (Emphasis upon right.) Early in March 1937, a growing "nervousness" culminated in his being taken off of all treatment. Mother observed a marked change in 1 week. He continued off treatment for several weeks. The stuttering has disappeared, but his behavior has become a serious problem.

CASE 4.

Physical Diagnosis: Right Hemiplegia.
Speech Diagnosis: Dysphemia—Medium.
C.A. 1/1/37 13 yrs. 5 mo.
Sex: Female.
Birth History: Full term pregnancy, normal birth.
Developmental History: Breast fed for several months. Hemorrhage from naval at 3 weeks. Convulsions. Blood transfusion. Frontenal puffed: Spine punctured. Fell at 3 yrs. of age; was unconscious for 3 hours. Condition recognized as epilepsy. Early seizures were from 1 to 8 hours in duration and child became rigid. Walked at about 3 yrs. No sound except crying before 1 yr. of age. Stutter first noticed at 18 mo. By 3 yrs. of age had increased considerably. Is the second of three children.
Family History: All right-sided as far as reported.
School History: Entered at about 6 yrs. Psychological findings M.A. 6-4; I.Q. 91 (6/10/30). Retest: M.A. 8-4; I.Q. 67 (Feb. 1936). Adaptation poor. Is a behavior problem in attitude and class management. Is deteriorating.
Laterality History: Uses left hand: Right is paralyzed. Work on right side recommended. Difficult to keep her at it. Wrote well, though slightly larger than average of her age and grade. After 5 years' training, in many activities left hand still assisted by right. Left-eyed (1935).
Physical Treatment: General coordination, weaving and woodwork, emphasis upon the right side.
Speech Therapy: All activities possible used with lead with right hand. Mental hygiene was frequently applied.
Results: Behavior greatly improved. Ability to use right hand greatly improved. Noticeable improvement the first year.

Early in the second year the stuttering completely disappeared and carried through to the end of the school year (4 mo.). For two years more, work on the right side continued, with occasional reverting to left side. During this period there was occasional stuttering. Also during these two years, the room teacher observed a dulling of ability in school work. During the next year the dulling was more rapid and complete. It was increasingly difficult for her to continue without constant reminding. The stutter was again noticeable.

CASE 5.

Physical Diagnosis: Right Hemiplegia.
Speech Diagnosis: Dysphemia—Severe. Tonic and clonic spasms.
C.A. 1/1/37 5 yrs. 5 mo.
Sex: Male.
Birth History: Premature (7½ mo.). Very rapid delivery. Weighed 3½ lb., no rickets. Had whooping cough about 1½ yrs. of age. Had not talked much before 1½ yrs. Stutter present. Started walking about 2 yrs. of age. Operation on heel cord, back of knee and right arm at 2 yrs. For three years (2-5 years) had a good deal of physical therapy on the right side. No change in speech. Stutter increased after 3 mo. in school. Is the youngest of 3 children.
Family History: Mother is left-eyed. One paternal cousin left-handed; one maternal cousin is left-handed.
School History: Entrance 5 yrs. Good adaptation. Psychological findings M.A. 5-2; I.Q. 103 (9/28/36).
Laterality History: Uses left hand (right more crippled). Mother feels he uses right more now than previously. 1/7/37 beginning of shift to right. Is right-eyed (1937).
Physical Treatment: Much by way of ambi-lateral.
Speech Therapy: Effort to establish dominance through use of right hand in all activities.
Results: Still under observation.

CASE 6.

Physical Diagnosis: Paraplegia.
Speech Diagnosis: Dysphemia—Medium. Clonic spasms.
Dysarthria—Medium.
C.A. 1/1/37 11 yrs. 10 mo.
Sex: Male.
Birth History: Premature (7 mo.), normal delivery.
Developmental History: Brain hemorrhage at birth. In incubator for 6 weeks. Breast fed 9 mo. No convulsions or rickets. Has had measles. Night terrors until 3 yrs. of age. Walked at 2½ yrs. Talked at about 1 yr. Dysarthria present. Stutter first noticed about 5 yrs. Is second of 3 children.
Family History: No history of twins, strabismus or left-sidedness. Younger child (boy) also had articulatory disorder.
School History: Entered at 5 yrs. Very good adjustment. Psychological findings M.A. 4-6; I.Q. 81 (9/20/30). Had difficulty in orienting his writing.
Laterality History: Left-handed from beginning. Sucked left thumb. Some effort made to shift him to right side. This was discontinued after stutter began. Seemed to eat and write more easily with right. Tests (informal) indicated left-sidedness. Training on left began 10/24/32. He has remained left-sided to date. Amphiocular (1935). Right-eyed (1937).
Physical Training: Walking, balancing, general coordination. Getting up from and down onto floor.
Speech Therapy: Auditory stimulation; tongue, lip and jaw exercises. Work on pitch. Work for establishment of cerebral dominance—development of left side.
Results: Stutter cleared up (1935). Dysarthria still persists though greatly improved.

CASE 7.

Physical Diagnosis: Diplegia.
Speech Diagnosis: Dysarthria—Severe.
Dysphemia—When treatment is on right side.
C.A. 1/1/37 8 yrs. 10 mo.
Sex: Female.
Birth History: Full term pregnancy. Difficult labor, face presentation—pushed back and righted.
Developmental History: Spasticity noticed in 5 days. Breast fed for 1 yr., no rickets. Convulsions in the hospital. Had chickenpox (hard) and measles before 3 yrs. of age. Talked a few words at 2½ yrs. of age. Dysarthria present. Does not walk at 8 yrs. 10 mo. Work at Curative Work Shop. Heel cord lengthened at about 5 yrs. of age. Glasses fitted 1/1936. Is youngest of three children.
Family Hitsory: Father is left-sided; one paternal aunt also left-sided.
School History: Entered school at 6½ yrs. M.A. 5-1 (?); I.Q. 91 (?) 9/11/33. Adaptation—good.
Laterality History: Left hand and foot seem stronger. Effort made to train the right resulted in stuttering. Discontinuance of treatment resulted in stuttering disappearing. Eyedness test unsatisfactory.
Physical Treatment: Individual relaxation and coordination. Tank—relaxation and balancing.
Speech Therapy: Auditory stimulation on left side. Tongue, lip and jaw exercises. Exercise for breath control. Addition of finger painting in 1936. Printing attempted but not successful.
Results: Stutter not returned since discontinuance of work on right side. General speech ability greatly improved. Breath control still faulty.

CASE 8.

Physical Diagnosis: Diplegia (athetosis).
Speech Diagnosis: Dysphemia—Severe. Tonic blocks.
Dysarthria—Mild.
C.A. 1/1/37 16 yrs. 9 mo.
Sex: Male.
Birth History: Full term pregnancy. Breech birth, prolonged labor. Brain hemorrhage and in coma at 4 days.
Developmental History: Breast fed for 6 mo., bottle fed for 13 mo. Digestive disturbances to 1½ yrs. No convulsions. Had diurnal enuresis and night terrors. Fell from a table as a small child. Any injury or bruise not noted. Talked at 9 mo. Walked at 3 yrs. Fell and did not walk again until 6 yrs. Stutter began at 6 yrs. Dysarthria present at beginning speech. Is older of two boys. Fractured right ankle at 4½ yrs.
Family History: Paternal uncle left-handed in all activities. Father under care of psychopathic hospital frequently. Mother chronic complainer.
School History: Entered at 7 yrs. Good adaptation. Psychological findings M.A. 6-0; I.Q. 91 (10/25/26).
Laterality History: Early left usage. After observations in several departments and after conferences with parents, training was begun on the right side. He was fair to good in sticking at the task of making himself right-sided. When he left Dowling one year ago to go to high school, he was still using his right hand. Now (1937) is using left. No eyedness test.
Physical Treatment: General coordination, class getting down onto floor and up again.
Speech Therapy: Relaxation; rhythms such as tapping, swinging arms, learn control of breath, tongue, lip and jaw exercises; auditory stimulation, finger-pointing, cutting, writing, etc., on right side. Use of voluntary stutter, and "stop and go."
Results: Sound substitutions cleared, stutter was greatly improved. Speech still slow. H.S. teacher reports (1937) that stutter has increased again.

The question naturally arises as to how the native handedness (or better still sidedness) can be determined. The procedure used at Dowling is this: Thorough and as complete as possible case study is made, particularly including family history of sidedness or laterality, twinning, strabismus, and speech disorders; the child's own history of laterality or sidedness, of speech, social and educational abilities, illnesses and accidents, and his intelligence. Then tests and observations are made at home and school as to spontaneous use of hands. Tests, observations, and history are then evaluated. Occasionally such a picture of confusion is presented that in young children further observation is recommended. Occasionally what seems to be a serious error is made. One such was the following, a diplegic spastic, a very severe stutterer.

CASE 9.

Physical Diagnosis: Diplegia—Severe.
Speech Diagnosis: Dysphemia—Severe. Clonic and tonic spasms.
Dysarthria—Severe.
C.A. 1/1/37 10 yrs. 2 mo.
Sex: Female.
Birth History: 2 weeks late, dry birth; cord around neck twice; leg around cord. Doctor pulled and pressed, used 250 lb. pressure; the head snapped back into place; left arm broken; child kept alive by artificial respiration.
Developmental History: Breast fed for a few weeks; fed on condensed milk for several months. No convulsions or rickets. Walked at 4 years after electrical treatments; fell frequently. Talked at 2 years, dysarthria present at begin-

ning. Stutter began about 5 years of age. Tongue very thick, could not protrude it until about 6 years of age. Has 3 half-brothers and 1 half-sister (the mother's children).

Family History: Mother was left-sided, is now ambidextrous. She is very emotional, her speech is very rapid. The half-sister is left-handed; two of the brothers are very low mentally. A maternal cousin is also very low mentally.

School History: Entered school at 5 yrs. Good adaptation. Psychological findings M.A. 6-6; I.Q. 91 (?). Retest Jan., 1937 M.A. 9-0; I.Q. 74. (1/21/32).

Laterality History: Seemed to be left-sided. Pressure to make her right up to 5 yrs. Some informal tests in 1932 indicated left side as dominant. Work on left partially from 1932 to 1937. In 1933, right hand seemed more easily used than previously. In 1936 right more frequently was lead hand. In 1937 as many of the clinic tests for laterality as she could do were given. These definitely indicated that the right side was "coming through." Work for right-sidedness begun in February 1937. Amphiocular (1935), left-eyed (1937).

Physical Treatment: Weaving—both hands. General coordination; ball bouncing; relaxation; tank.

Speech Therapy: All possible activities concentrated on left side. These included crayoning, cutting, tearing paper, rolling and bouncing ball. Work for breath control. Use of mental hygiene for "straight thinking." Writing added in 1934. Some auditory stimulation on left side. Use of "stop and go" therapy for stutter.

Results: All articulatory sounds except one (1) are easily accomplished; occasionally "s" and "sh" are blurred. This seems to be when that sound is stuttered on. Since going over entirely to right, more severe stuttering was heard on only one occasion. Previously there had been only a slight improvement, but now, on the whole, the stuttering has materially diminished.

The means used to develop a margin of dominance sufficient to run the speech muscles have been developed largely at Iowa under Dr. Travis and at Minnesota under Dr. Bryngelson. These include writing and talking exercises, in which writing a word precedes the speaking of it. With spastics the first problem frequently is to get writing developed. With this in mind the speech department at Dowling has worked out a series of paper, crayon and pencil sizes, and with the aid of the corrective gymnastics teacher, apparatus to hold paper. Blackboard work precedes paper work. It is serving a double purpose—one an unexpected one. It is enervating as we hoped. But it is also proving to be a means of communication which might otherwise be denied a child. Just how far reaching its results will be is not now predictable, since this procedure is only a year and a half old.

Besides writing and talking, all manner of activities, unilateral in nature are used. It is in this particular phase of the work that the physical therapist, occupational therapist and corrective gymnastic people are so closely associated. It is obvious that speech can be wrecked if cooperation is lacking. Sometimes stuttering has its onset seemingly quite suddenly, following treatment. It is well to consult a speech clinician immediately. Perhaps a case is a spastic—and both sides are seemingly equally affected. Is he to be left without physical therapy? Is the one side to receive more attention than the other? These questions and other similar ones arise time and again. They may be thus partially answered: If no speech disorder is involved, regular procedure should be followed, with observations. A speech disorder may thus be prevented. If the case is a speech case, proceed with caution. Perhaps good speech will have to be sacrificed for a better physical condition. Or perhaps physical therapy should be held in abeyance until a good, safe margin of dominance can be established. These are definitely matters of cooperation between departments. Too much cannot be said about this matter of cooperation. We all often go on our own little job forgetting that it dovetails into some other equally important phase of a child's development.

Department of Physical Therapy

Physical therapy has proved so advantageous in cases such as fractures, diseases of metabolism and nervous disorders that almost every general hospital would find considerable use for such a department. This specialty frequently hastens convalescence, shortens the patients' average stay in the hospital, and improves end results. Hospitals seeking guidance in the organization and management of a modern physical therapy service are advised to observe the requirements which have been laid down by the American College of Surgeons in a Minimum Standard for Physical Therapy Department in Hospitals and explained in detail in the *Manual of Hospital Standardization*.

Acquaintance with the advantages of physical therapy has also demonstrated its dangers in unskilled hands. Knowledge of physiology and anatomy is essential for the person administering the treatment; otherwise harm may result. Besides his special training in this field, the director should be a medical graduate. It is because of lack of insistence upon this qualification that some disrepute still clings to the practice of physical therapy. Complete records of response to treatment are particularly important because of the establishment of physical therapy as a recognized science.

Occupational therapy is still not extensively practiced in the general hospital, although it has thoroughly established itself in institutions for mental and nervous patients, in orthopedic hospitals and in tuberculosis hospitals and sanitariums. As an aid to the contentment of the patient whose stay in the hospital is long it cannot be over-estimated. Every progressive hospital which has not already some provision for it should consider the establishment of such a department with a qualified director who will work under the supervision of the attending physician.

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Residual Neuromuscular Hypertension: Implication for Physiotherapy*

Part IV: Possible Causes as Well as Consequences of Excess Tension

Josephine L. Rathbone, Ph.D.

Disturbances in the Functioning of Internal Organs. Involvements in the respiratory, digestive, and circulatory systems will be discussed as accompaniments of residual hypertension of the skeletal muscles. Our records present sufficient evidence to indicate that increased tension in either the smooth or the skeletal muscles brings about an increase in nervous impulses, resulting in a reflex stimulation of other muscles, either smooth or skeletal. Since through the nervous system, every part of the body is directly or indirectly in potential communication with every other part, the stimulation of any sense ending may result in nerve impulses being delivered, ultimately, to any or all muscles or glands.

The results of overactivity of the vagus nerve, as listed by Aldrich,[39] and discussed above, are mainly disturbances in the breathing mechanism—stridor, dyspnea, choking attacks, asthma, laryngospasm spasmodic coughing and irregular breathing. If space permitted, it would be interesting to discuss the instances when our cases revealed these many conditions. It became apparent in our study that spasm in the speech and respiratory mechanisms are not infrequent accompaniments of general hyperexcitability of the neuromuscular system.

So also spasm of various parts of the smooth muscle of the digestive system accompanied the skeletal hypertonus in our cases. As everyone knows from experience, whenever one is "subjected to any exhausting experience, any excitement, pleasurable or the reverse, or any undue exertion, whether mental or physical, one may note the subsequent gastro-intestinal derangement, including even a coating of the tongue." The most trival exertion "may set loose the most extreme reactions in the gastro-intestinal tract—motor, sensory, or secretory."[40]

Motor disturbances of the gastro-intestinal system are exhibited often in constipation and diarrhea. The first muscular consequence of an increase in irritability of the digestive tract is constipation, as a rule. According to Alvarez, the sphincters of the stomach and of the colon, which he believes are normally more sensitive than the rest of the tract, "become so irritable and tonic that they cramp down and interfere with the progress of food and its residues."[41] According to the same authority, only when the irritability becomes extreme does diarrhea result. Evidence from our records indicates that the observations of Alvarez are correct.

A spastic oesophagus, which Jacobson believes is caused definitely by reflex stimulation from the skeletal musculature through augmentation of proprioceptive impulses from that field,[42] was recognized definitely in several of our cases. During the first weeks of treatment, one of our cases could not fully inhale or fully exhale, and any accompanying excursion of the abdominal wall would cause explosive expulsions of gas from the throat and rectum. She experienced, furthermore, a choking sensation. All these symptoms finally disappeared as she became more skilled in relaxing.

In connection with most of the muscular reactions of the gastro-intestinal tract noted in our cases, sensory symptoms were present also. This fact raises the question as to whether or not these sensory reactions may be the source of increased reflex tension in the skeletal muscles. It has proved difficult to decide how far an acute gastro-intestinal upset of dietary origin, for instance, might increase the tonus of the general neuromuscular system. If acute pain were present, it is quite possible that, as will be discussed in the next article in this series, tendency would be for the muscles of respiration and the flexor muscles of the trunk, at least, to be affected. If the subject were emotionally concerned about his gastro-intestinal sensations, they might serve to increase general hyperexcitability from that source. From the observation of these particular cases, during their periods of treatment, it appears, however, that sensory impulses from the gastro-intestinal tract do not increase reflex tonus of the skeletal muscles as frequently as tension of the general musculature, from whatever cause, calls forth gastro-intestinal symptoms.

A few statements should be made concerning the secretory changes in the gastro-intestinal system accompanying the type of sensory changes already mentioned. Emotions definitely affect the digestive secretions. Some observers claim that the decrease in acidity in the stomach is greatest when the muscular exertion is accompanied by emotional excitement, and so suggest tranquility of mind, as well as rest of body for a short time before and after a meal, in order to augment gastric acidity.[43] Some observers claim that different emotions have different effects on the digestive fluids, and suggest that secretion can be induced by pleasurable emotions and stopped by unpleasant or painful ones.[44]

It is logical to conjecture that digestive disturbances may be due to secretory involvements. Many of the cases under advice complained of food idiosyncrasies or "stomach upsets." In fact, the stomach upsets mentioned by many of our subjects seemed to accompany their periods of extreme physical or mental effort.

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*Residual Neuromuscular Hypertension: Implications for Education, by Josephine L. Rathbone, Ph.D., published by the author, New York City, 1936.

The circulatory system. The circulatory changes which accompany general neuromuscular hypertension apparently are numerous and varied, as judged in our cases. These various symptoms may be explained by the fact that the heart's action is aided by the resistance offered through muscular contraction in moderation, but that muscular contraction in excess is an obstacle to circulation. "A fused contraction of a large number of the muscle fibers might be expected to occlude the arterioles and capillaries and so reduce the blood flow. . . . A prolonged reduction in flow through a muscle produced in this way during a long sustained contraction would certainly increase the degree of fatigue and make possible summation at a lower frequency."[45]

The most frequent circulatory accompaniment of residual neuromuscular hypertension recognized in our cases was chilling of the body surface.

Several cases showed circulatory reactions definitely associated with their particular form of activity. Two of the cases showed their paling and chilling particularly in the hands and arms. Of all the cases coming for aid these were the ones carrying the greatest actual responsibility and doing the most exacting desk work. It was after writing or engaging in mental effort, which would eventually be recorded in writing, that their hands and arms appeared most tense and chilled. It has been interesting to observe during the four years of collecting the data for this dissertation that the cases which would be classed as engaging definitely in academic effort frequently had their most marked tension in the writing arm.

To return to a discussion of circulatory symptoms, one particular case should be briefly described. His complaints were definitely in the feet and lower legs. His arches showed signs of static strain; he had been given Whitman foot-plates with only mild relief of symptoms. Massage and rhythmic exercises always made the feet and legs feel much better for several hours after treatment, but until he was treated as a general tension case, his symptoms in the legs always returned the following day. They were never apparent when he was walking but became acute after he had sat still in class for two or three hours. Classmates of his claimed that he was exceptionally alert, was always on the edge of his chair eager to participate in discussion, while he gripped his legs around the chair legs. It was at such times that he complained of his legs becoming numb with cold, tingling, and feeling prickly. It was surmised that another reason why he got the overdose of tension in his legs was because one of his daily occupations demanded considerable static contraction in the act of standing on the alert. He assisted in one of the college cafeterias every noon. It seems quite apparent from an observation of the above cases that increase in residual neuromuscular tension in the extremities, at least, from whatever cause, may disturb circulation and cause sensory reactions.

Some of the chilling and tingling in our cases may be due to the fact that individuals with residual neuromuscular hypertension may become anaemic. Beard, many years ago, observed this possible connection. He stated that anaemia in the vascular system accompanying the state which he called neurasthenia might be due to acute or chronic diseases, might run acute or chronic courses, and might cause acute or chronic diseases.[46] More recently, pernicious anaemia has been recognized accompanying neural and psychic symptoms,[47] and exhibiting itself by numbness, tingling, and weakness.[48] At the Peter Bent Brigham Hospital in Boston, hundreds of cases of pernicious anaemia have been studied since the institution of liver therapy in the summer of 1925. Young[49] reports, in a study of 515 cases, 26 per cent showing neurological signs marked by reflex changes and ataxia. The early signs were girdle pain (abdominal), bachache, neuritis—brachial and sciatic, and mental changes.

In the case discussed above, when the symptoms in the legs were so persistent, a blood examination was recommended. It brought no suggestive results. Perhaps Sargant's findings indicate why anemia was not discovered in this case. Sargant claims that nervous involvement accompanying anemia bears no relation to the severity of the anemia, yet he found that the nervous phenomena steadily improved if larger doses of iron were given, despite a rising or falling of the blood count.[50]

Certain other blood changes have been recognized in cases of increased nervous excitability. In the literature on the subject one finds reference to the fact that certain states of sympathetic hypertonia—fear and maniacal excitation—are usually accompanied by polynucleosis, while "relative leukopenia found in most asthenic conditions, nervous depressions or stupor, and in certain cases of asthma, migraine, epilepsy or periodic psychosis, appears to be in relation to a functional diminution of sympathetic activity or stimulation of the vagal tonus.[51]

The white cell count of man is known to be very unstable. During rest in the recumbent position with complete physical and mental relaxation the leucocyte count is steadiest and at a minimum.[52] It changes as much as 60-100 per cent with variations in activity, such as moderate exercise, changes in posture, and even changes in the mental state.[53] As is well known, adrenalin injections cause leucocytosis in which the increase in lymphocytes is most marked, and an increased leucocyte count accompanies epileptic attacks and hysterical seizures.[54]

From an experiment by Martin[55] on convalescent hospitalized patients without any organic lesions, one learns that the minimum of leucocyte count is to be found during the period when the patient's condition approximates most nearly to complete physiologic repose and tends to rise with any increase in the patient's mental and physical activity. Martin observed a rise in the total leucocyte count after five minutes exercise varying from 15.75 to 48.0 per cent and averaging 27.4 per cent. Furthermore, there was a leucocytosis folowing emotional disturbance. He concludes that the leucocyte count, like temperature, tends to rise in the late afternoon and early evening, because this is to be regarded physiologically as the most active part of the day.

Summary of evidence concerning the relationship between residual neuromuscular hypertension and the functioning of the respiratory, digestive, and circulatory systems. These data afford ample evidence that individuals with residual hypertonus in their skeletal muscles have, also, various hypertensions in their smooth muscles. No one type of smooth muscle seems to be affected. The trachea, oesophagus, stomach, intestines, bladder, and uterus have all given evidence of increased spasm in our cases. The questions remain, however: is the relationship a cause-effect one; and, if so, in which direction? Evidence from an analysis of these cases seems to indicate that hypertension of the skeletal muscles from whatever cause will result in a reflex hypertension of the muscles of the hollow viscera and tubes.

The increased tension of the heart and vasomotor system generally seems to be a possible aftermath of increased tonic contraction of skeletal muscles. The number of both red and white cells in the circulating

blood under varying circumstances raises questions relative to the function of rhythmic exercise in liberating these cells from their storage places, as well as to the effect of posture on congestion in the splanchnic area.

Infections. The consideration of the leucocytes is of particular interest in connection with the question of the relation of infection to residual neuromuscular hypertonus. As is well known, whenever the body is trying to fight an infecting organism, an increase in leucocytes is to be found in the blood stream. If, as the previous evidence seems to indicate, there is an increase in leucocytes with increase in activity, it may prove difficult to decide whether the leucocytosis is due to infection or to exertion.

Infectious diseases as well as foci of infection are given the credit for many nervous breakdowns and exhaustions. One is warned that when fatigue is not due to lack of rest or some obvious cause it may be a sign of the oncoming of a severe illness. Many physicians believe that a careful and thorough physical examination, including serological and x-ray studies, is more likely to reveal the origin of tension and distress than any investigation along psychoanalytical lines.[56] Chronic tonsillar infections are held responsible for breathlessness, a sense of constriction of the throat, muscle trembling, and muscle weakness, with emotional and psychic upsets.[57] Neuroses with resulting hyperexcitability and sleeplessness are considered frequent accompaniments of nose and throat, oral, middle ear, and sinus infections.

It is true that several of our cases complained of localized infections. Three cases had had their tonsils removed after their symptoms of fatigue and muscle soreness had developed. Four had carried serious sinus infections for several seasons. One had had a diagnosis of duodenal ulcer, and another of gall bladder infection since their tension had exhibited itself. Several cases had had appendix attacks, one occurring while under observation. Many of the cases complained of "arthritis" and "neuritis," conditions which have been associated, in medical experience, with foci of infection.

It was difficult to come to any conclusions from these data concerning the relation of hypertension, as a phase of fatigue, to the infections. Since we observed no case of tension develop totally after an infection was recognized, and since many of the diagnoses of localized infection came after a request had been made to physicians to help clear up the residual tension, it is necessary to conclude simply that infections and neuromuscular tension are associated; and that when a person becomes neuromuscularly tense, he may open his system to infectious invasion.

A few further comments are in order. When a focus of infection is localized sufficiently to show in a roentgenogram, it may not be giving off as much toxic material as when it is less organized. Furthermore, from the above discussion of leucocytosis with increases in activity, it becomes apparent that serological examinations revealing a marked increase in leucocytes in the blood might indicate a state of fatigue from muscular effort instead of a true infection. It has never been conjectured, as far as the literature on the subject reveals, that the leucocytes are liberated to attack so-called fatigue toxins themselves.

It seems most logical to consider infections and emotional disturbances in connection with neuromuscular hypertension in much the same light as arthritic specialists now consider them in connection with their subject, as part of the symptom syndrome.

Furthermore, one must not forget that during infections the body temperature usually reaches that level which is most favorable for muscular activity. It is probable that the heat generated during infections actually helps to relax the body. One must reserve judgment concerning the relationship betwen infection, in general, and residual neuromuscular hypertension until laboratory physiologists and doctors of physical medicine have had a longer time to work with the newly devised electrotherapeutic machines to induce hyperpyrexia.

Jacobson has contended that infections, whether systemic or localized, cannot cause an increase in muscle tensions unless they are perceived.[58] It is surely true that consciousness of illness or throbbing pain will markedly increase the residual tonus, partly because of the pain sensations themselves and partly because of the emotional factors connected with fear. Before discussing these two important causes of residual neuromuscular hypertension, one should consider the subject of poisoning from drugs.

Drugs. In cases without number the condition of relaxation which precedes the curious phenomenon of sleep has been induced by morphine and chloral, which relax tense nerves and cause sound sleep.[59] Whereas some authorities claim that bromides, sodium and potassium, are preëminently useful in neurasthenia and hysteria, because they are not dangerously toxic nor habit forming when administered in small doses, even over an extended period of time;[60] others claim that bromides affect the brain, the cord, and the peripheral nervous system,[61] and are as dangerous as the other drugs. These authorities believe that toxic cases with lowered and impaired resistance and mental cases with lowered resistance and poor circulation and suffering from insomnia are particularly susceptible to bromidism. They believe that bromidism results in confusion, restlessness, violence, and the syndromes of symptoms resembling mania and paresis—insomnia, excitability, hallucination, rash, coated tongue, vile breath, constipation, excessive flow of saliva, atonic gait, loss of the patellar reflex, and ataxic speech. They claim that many a psychoneurotic has come to them for treatment with signs of bromide poisoning corroborated by the determination of a high bromide content of the blood.[62]

It may be that the hyperexcitability of many of the cases under observation may have been increased by bromides, for some of them admitted to taking that form of inducement for sleep; but a definite statement on this point cannot be made. It is possible that the degree of hyperexcitability recognized in these cases may have been due more to the lost sleep than to the bromides.

No efforts were made in this study to check the habits of the individuals in regard to smoking and to drinking coffee, tea, and intoxicating beverages. It would have been extremely difficult to check these practices accurately. There is some real doubt, furthermore, that they have a long-germ physiologic effect. They do have at least an immediate effect upon neuromuscular tension, however; for the chief reason, except custom, which prompts the use of any of these so-called stimulants is the pseudo-freshness or alertness which they give at first—an alertness not unlike that characteristic of certain degrees of fatigue.[63]

The immediate effect of all these drugs is to keep an individual working or playing when he is already fatigued. For this very reason they are dangerous. Even the pharmocological action of tobacco is to stimulate before partially depressing the sensory nerves and the endings of the motor nerves in voluntary muscles, as well as the sympathetic and parasympathetic ganglia of

the autonomic nervous system. The reaction is exciting and fatigue making, then paralyzing.

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(Editor's Note: This is the conclusion of the fourth article by Miss Rathbone. The fifth article will appear in an early issue.)

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The Physiotherapy Review

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Not so many years ago it was matter of grave discussion at our meetings both national and local as to how we could bring the American Physiotherapy Association and its ideals to the attention of the medical profession. We were young and virtually unknown, but we were very much in earnest and determined to make our profession a worthy one in spite of the fact that in at least one state we had to be licensed with the beauty operators. Our efforts, therefore, were first focused upon educational standards as we realized that a well-trained technician could do more to assist the physician and to become an indispensable part of his program in the care of the patient. Although we made mistakes, these were offset in time with the gradual building up of standards and the realization of schools training technicians that they wished their graduates to be eligible for membership in our organization. We were also cognizant of our own limitations and appealed to the Council on Medical Education and Hospitals of the American Medical Association for assistance. The result is well known. The Council on Physical Therapy of the American Medical Association puts its mark of acceptance on only that equipment which measures up to specified standards, and the Council has also brought to the attention of physicians and hospitals that a well-trained technician is the cornerstone of any department. These combined efforts have brought about a friendship and cooperation which seemed remote and almost impossible a few years ago.

For a number of years past the American Physiotherapy Association has had exhibits of physical therapy technics at the annual meetings of the American Medical Association and of the American Congress of Physical Therapy.

During the past year further developments in our scope have taken place. We are no longer isolated. Because of our experience and determination that standards should be adhered to, other organizations have turned to us for advice. The newly formed Crippled Children's Division of the Children's Bureau requested that a member of our organization be appointed to its advisory board to assist in giving advice concerning the care of the crippled child; the National Organization of Public Health Nursing formed an orthopedic advisory committee and asked that a member be appointed to assist in solving their physical therapy problems; the *Crippled Child*, organ of the International Society for Crippled Children, asked that a member be appointed to its staff to assist in procuring material; the American Registry of Physical Therapy Technicians asked that a member be appointed to their advisory board. The Review has done its part,—it has kept pace with a growing profession, and recognition of this is shown by the increased number of subscriptions above our membership list as reported to you in the Annual Report of the Business Manager in the July-August 1937 issue.

Last, but not least, is every member who in her pride to do a good job and adhere strictly to standards has made all this possible. Without the cooperation and the confidence of all members in the officers who are their spokesmen we might still be floundering. When you hear the question "Why does not the American Physiotherapy Association do something?"—look back and see what has been accomplished,—look ahead and see an ever-widening path of service.

NOW is the greatest of moments, the most real thing of which we can be aware. . . . To seize it as an opportunity means bracing ourselves up for action, decision, bite, endeavor . . . not vague resolutions but insistent occupation, not irresolute hopes but intense purposes, not languid aspirations but ready service, not "Time will tell," but "I will tell Time" . . . the errors of impetuosity are far less serious than the errors of caution and indolence and the enervating paralysis of procrastination. . . . There is no failure except in leaving off trying.—Arthur Ponsonby, "Life Here and Now." (Conclusions derived from an examination of the sense of duration. As found in "Nature," Aug. 28, 1937.)

The editorial staff wishes to announce that the size of the pages of the next issue of the Review will be reduced somewhat in order to conform with that of the majority of the medical journals.

The REVIEW staff wishes to announce that Katherine King has accepted an appointment to serve as an associate editor. Miss King will fill the vacancy left by the resignation of Mrs. Margaret Campbell Winters.

News Notes

It is with deep regret that the Executive Committee has learned of the sudden death on October 15th, by automobile accident, of Mrs. Lois A. Whitfield, of Newark State School, Newark, New York.

Mrs. Whitfield was the delegate of the Western New York Chapter at the Annual Convention at St. Paul, Minnesota, in June, and presented a film, "A Day with a Spastic Child at Newark School," which some of our members will recall with interest.

Although Mrs. Whitfield became a member less than two years ago, she had shown such interest and enthusiasm in Association affairs, we share with her chapter associates and friends the sense of loss which her passing means.

Edgar F. Allen, founder and President Emeritus of the International Society for Crippled Children, died at his home in Elyria, Ohio, on September 20, 1937. Through "Daddy" Allen the interests and efforts of a great many people were enlisted to aid in the care of the crippled child. The widespread influence of the International Society for Crippled Children is due to his unselfish and untiring devotion.

A certificate of honorable mention was awarded to the American Physiotherapy Association and the Visiting Nurse Association of Chicago for their exhibit at the 16th Annual Session of the American Congress of Physical Therapy in Cincinnati, Ohio, September 20-24, 1937.

The Canadian Physiotherapy Association will hold a meeting in Toronto, Saturday and Sunday, January 29 and 30, 1938. A cordial invitation has been extended to all members of the American Physiotherapy Association. Saturday morning will be devoted to business meetings, while the afternoon program provides lectures and hospital visits. A special lecture on treatment of paralysis by suspension will be given by two teachers at the Chartered Society for Massage and Medical Gymnastics. There will be informal gatherings and a tea on Sunday. Places and hours for meetings have not yet been decided, but further information may be obtained by writing direct to Miss Katherine Walker, Secretary-Treasurer, 4191 Sherbrooke Street West, Montreal, Quebec.

The Western New York Chapter, at the invitation of Dr. Vaux, superintendent, and Mrs. Whitfield, held a fall meeting at the new physical therapy building of the Newark State School. The Central New York Chapter was also invited to this meeting. On Sunday morning an opportunity was given to see the entire physical therapy building, including the pool. A little play, "The Three Bears," was given by some of the children in the physical therapy department. A special program and dinner were arranged, the program including a movie entitled "A Day With a Spastic Child at Newark State School," and a talk on "Spastic Paralysis" by Dr. Roscoe Severance, Orthopedic Surgeon, Syracuse, with a discussion by Edgar A. Doll, Ph.D., Director of Research at the Training School, Vineland, New Jersey.

The Ohio Chapter held its semi-annual meeting on October 30, 1937, at the Charles Feilbach School, Toledo. A new district which has been formed in Cincinnati was admitted to the chapter at this meeting, the program of which follows:

10-11 A. M. Registration.

Tour of building.

11-12 A. M. Reading and discussion of Dr. Earl Carlson's recent paper on the "Treatment of the Birth Injured."

Luncheon—12-1 P. M. Charles Feilbach School.

1-2 P. M. "Inferiority of the Crippled Child"—Burt G. Chollett, M. D., Chief of Staff, Children's Convalescent Home; Orthopedist, St. Vincent's Hospital, Toledo.

Demonstration of cases.

2-3 P. M. Orthopedic film—"The Prevention of Deformity in Poliomyelitis." Courtesy of the Maryland League for Crippled Children.
Discussion by Dr. Albert Bershon, Orthopedic Surgeon, St. Vincent's Hospital, Toledo.

3-3:30 P. M. "Method in Corrective Speech"—Mrs. Helen Kiefer, Instructor in Remedial Speech.

3:30 P. M. Business meeting.

Vocational Service

The Secretarial office would be glad to hear of any members interested in positions in the Middle West, Pacific Coast, or Texas. Physical therapists with nursing training are especially desired. There are vacancies in Public Health programs, hospitals, and doctors' offices.

ABSTRACTS

John S. Coulter, M. D.

Effect of Baths at Different Temperatures on Oxygen Exchange and on the Circulation

H. C. Bazett, J. C. Scott, M. E. Maxfield, and M. D. Blithe in Am. J. Physiol., 119:1:93, May 1, 1937. (From the Departments of Physiology, University of Pennsylvania, and of Hahnemann Medical College, Philadelphia.)

Summary

Comparisons have been made between estimates of cardiac output by the acetylene procedure and by calculation from blood pressures and pulse wave velocities, when the subjects were immersed in cool, neutral or warm baths. In spite of the marked changes in the vascular conditions the two methods gave results which indicated the same picture and did not differ from one another on the average by more than plus or minus 14.7 percent, provided that the experiments made in the summer months on two subjects be excluded. Normal agreement was obtained in these subjects in the winter.

Such systematic discrepancies were seen only when the cardiac outputs estimated from the blood pressures exceeded 3.4 liters per square meter per minute; it is argued that the cardiac outputs were probably high and beyond the capacity of the acetylene method with the sampling times used.

On such interpretations the cardiac output might be slightly increased or decreased with a slowing pulse in cool baths. It was considerably increased with a larger stroke volume and increased pulse rate in the early stages of warm baths and was reduced to a basal level in spite of a high oxygen consumption in the later stages of warm baths as the result of dehydration. In this latter stage the stroke volume was very small. The subjects were much more susceptible to such dehydration in the winter, so that the initial increase in cardiac output was less marked and any increase in stroke volume rarely demonstrable.

In the terminal stages of winter experiments with warm baths, quite high A-V differences (up to 82.5) might be found. In view of the high skin circulation, these must have implied very low saturations in active tissues.

In warm baths both systolic and diastolic pressures may be lowered initially, but the fall in diastolic pressure is far less than those commonly described. During incipient circulatory failure following dehydration both pressures tend to be raised.

The large arterial trunks show properties which imply their utilization as a blood reservoir; the pulse wave velocity in the ascending aorta is slowed in cool baths when the peripheral arterioles are constricted, quickened in warm baths when these are dilated, and becomes still more rapid as the individual attempts to compensate for dehydration.

The pulse pressure may be considerably increased, even when the stroke volume is decreased; such changes depend on decreased distensibility of the large arterial trunks.

Pulse rate changes to temperature are not explicable as the simple effect of either surface or rectal temperature changes; the factors involved are complex.

The increased oxygen consumption with rise in body temperature cannot readily be related to changes in rectal temperature; if, however, it be compared to changes in average body temperature the data give a value for Q_{10} of about 2.9.

The Elliott Treatment as Prophylaxis for Gonorrhea in the Female

George A. Williams, M. D., Atlanta, Ga., in Am. J. Ob. & Gynec., 33:4:694, April 1937. (From the Department of Obstetrics and Gynecology, Emory University School of Medicine.)

Prophylactic treatment for gonorrhea in the male has been used for years with gratifying success, but comparable methods are discouragingly inefficient when applied to the female. One has only to consider the principles of chemic prophylaxis and at the same time review the different anatomic and pathologic bases of gonorrhea in the two sexes to appreciate the reason for this. In the male, gonorrhea begins as an inflammation of the terminal portion of the pendulous urethra, lined with resistant stratified squamous epithelium, and almost devoid of glandular structures. In the woman, infective material is deposited upon the urethral meatus and the cervix uteri, both rich in glands and exposed during coitus to a massaging action which tends to implant the gonococcus in deeper layers of tissue than in the man. The anatomy of the female genitals also precludes the self-application of drugs which will remain in contact with the vulnerable surfaces for any length of time.

Noting the prompt response of acute uncomplicated gonorrheal cervicitis, urethritis, and paraurethritis to treatment with the Elliott method (no antiseptics being used) it occurred to me that prolonged intense heat might also be employed to prevent the development of the disease if treatment were begun during the stage of incubation. The number of such cases is small, but the uniform success of the method prompts this report.

Prevention and Correction of Deformities in Chronic Arthritis

W. Paul Holbrook, M. D., and Donald F. Hill, M. D., Tucson, Arizona. Southwestern Med., 11:5:161 (May) 1937.

In acute arthritis the necessity of bed rest is usually obvious. Rest the joints. Stop weight bearing on affected joints and stop strenuous use or trauma to joints, as this leads to continued irritation and destruction of the involved tissues. In practically all cases a non-sag bed should be used. Boards may be placed between the mattress and springs if necessary. It is important to start rest in correct posture. The patient is then to stretch out flat on his back, without pillows, for possibly three hours daily—one hour after each meal. The time may be varied according to the stage of the disease and to the amount necessary to keep correct posture. Arms are spread out to the side or abducted with palms up. Sand bags or other prop is used to hold the feet upright and allow the patient to relax with his legs extended. It is important not to allow pillows under the knees, to

cause ankyloses in flexion—a common mistake. Likewise, if the hands rest folded across the abdomen or chest, which is the comfortable position most patients assume, they are encouraging flexion contractions of the wrists and elbows. So, at least for one hour three times a day insist upon stretching in maximum extension.

Bed rest has not been used sufficiently in the past because of the fear of stiff joints. Many physicians advise their patients to walk regardless of pain and to keep up knee flexion contractions in the belief that joint motion is being preserved. Hence the patient, in fear of the wheel chair and often with severe pain, forces himself about, destroying the very joints that need rest.

Joint Motion and Exercise: At the onset of the disease, the patient should be instructed to move all of his joints through their greatest range of motion at least once daily. In the first week or two of the most acute or inflammatory types, this may not be possible without sively. Later, as the joints become less painful, the too much pain. At first then, and often for a long time, it is necessary for an assistant to move each joint paspatient is able to move them through their complete range in his set of exercises. Muscle exercises also are started at the onset of the disease. The physician or a physical therapist should instruct the patient in the correct exercise for every important muscle group in his body. In the acute stage the patient may be limited because of pain to only a few muscle groups that he can exercise once or twice a day without aggravating the disease. Soon, however, the average patient learns all the muscle group exercises and is able to do each ten to fifteen times in two or three periods daily. Thus, in bed, he not only improves his blood circulation but develops muscle tone and strength that will support joints when he is able to walk. A few active muscle contractions are worth a good deal more than any amount of massage. The list of exercises is developed according to the patient's individual needs. Generally, a full set is required, including arms and hands, legs and feet, chest, abdomen and back. Exercise of the extensor groups is ordinarily stressed more than exercise of the flexor groups. Exercises are always done on the bed and most of them while lying down. They are started with three movements each group once daily and gradually increased as tolerated. The exercise should always be slow and deliberate. With increased strength, resistance should be added. Resistance is best furnished by a trained physical therapist, nurse, or even a member of the family. Little or no equipment is required. Rest after an exercise period is essential.

In brief, the patient should have a strict daily routine with definite periods for posture, rest, joint motion and exercises. With this well established the program should be checked regularly by the physician for additions and subtractions as they become necessary.

This program can be started in the first few days after the physician's initial examination, and not until it is started should he look to the second phase of treatment which is the attempt to arrest the activity of the disease. Constant attention to all of the many little details in the program will save hours of work and worry in correction of deformities later on. The physician must not only be on the job constantly for months and years with a given patient, but he must instill into the patient the ambition, drive and persistence in daily routine that is so essential to maximum recovery. The patient must have the desire to get well and realize that fifty percent of the job is up to him in his attitude and faithful maintenance of routine.

Arteriosclerosis and Thrombo-Angiitis Obliterans

Report of Cases and Treatment

Alice R. Bernheim, M.D., and Isabel M. London, M.D., New York, J.A.M.A., 108:25:2102, June 19, 1937.

Treatment consisted in the use of measures to eliminate five vasoconstricting influences: tobacco, improper diet, worry, undue physical exertion and cold.

1. *Tobacco*—Those patients who continued to smoke or chew tobacco against advice failed to improve.

2. *Dietary Regimen*—The patients were given a regimen high in calcium and vitamins because of its favorable influence on vasospasm.

3. *Worry*—It was considered an important part of the therapeutic schedule to help the patient to gain insight into whatever domestic, economic or social difficulties might be disturbing him and to aid him in adapting himself to his limitations.

4. *Undue Physical Exertion*—It is desirable that the work done by individuals with peripheral vascular disease be commensurate with their diminished peripheral blood supply. Accordingly, patients were advised against exertion to the point of pain in the extremities. During the early period of treatment in the clinic, or until considerable improvement was obtained, as much rest as possible was advocated. Passive exercises as described by Buerger were considered an important part of the therapy. Patients were instructed to perform these exercises two, three or four times a day according to the following directions:

(a) Lie down flat in bed, with shoes and stockings removed.

(b) Raise both legs vertically into the air, bending them at the hips so that the soles of the feet face the ceiling. If this position is painful or impossible, the legs may be raised as nearly vertical as possible or may be rested against a wall to the side of the bed or against a chair placed on the bed.

(c) Keep the legs raised exactly one minute (by the clock).

(d) Lower the legs; sit up in bed with the legs hanging freely over the edge of the bed (not touching the floor).

(e) Keep the legs in this position for exactly one minute (by the clock). While they are hanging over the edge of the bed move the feet slowly back and forth and from side to side, at the ankle joint.

(f) Lie down flat in bed; rest for one minute in this position.

(g) Repeat entire process five times (that is, six times altogether).

5. *Cold*—The following instructions were given for keeping the extremities properly warm: In cold weather out of bed the patient should wear (a) white cotton socks, over them (b) woolen stockings covering the knees, (c) woolen underwear, (d) fleece-lined shoes if much outdoors, and (e) no tight or ill fitting shoes. In bed he should wear very loose woolen stockings, or cotton wadding, 1 to 2 inches thick, made into boots to cover the feet, legs and knees, and he should use an electric light bulb (under a cradle) only if thermostatically regulated at temperatures of from 92° to 93° F.

Hot water bags and other heating pads were forbidden. Warm socks for the feet and legs once or twice a day were advocated as follows:

1. Use one-half cupful of kitchen salt in 1½ gallons of warm water. Water should be comfortably warm —not too hot—soapsuds of castile soap may be used instead of salt, if preferred.

2 Soak feet once or twice a day for thirty minutes.

3. Dry feet thoroughly, being especially careful to dry the toes and the spaces in between the toes. Do not dry them roughly, taking care that the skin is not injured.

4. Dust plain talcum powder over and between the toes, so that you are sure the toes are dry.

Very light massage is allowed. We have failed to see good results from the use of diathermy, baking or hot and cold contrast baths; in fact, in a number of cases symptoms have become definitely worse after the use of these measures. Extremes of temperature are to be avoided, and heat may be as harmful as cold. Heat increases the metabolism of the tissues, which then require more blood, and, while vasodilitation is also produced by the heat, the impaired vessels are not able to supply sufficient blood for the added demand.

The Administration of Sodium Citrate

Sodium citrate was given from the beginning of treatment in all cases presenting severe symptoms, and it was given in other cases when improvement did not follow the foregoing dietary regimen. It was administered by mouth when it was not feasible to give it by vein.

Summary

1. A rationale of treatment of arteriosclerosis and thrombo-angiitis obliterans is as follows: (1) no tobacco, (2) diet high in calcium and vitamins, (3) the use of sodium citrate in the severe cases, and (4) proper care of the extremities.

2. Of ninety-nine cases of arteriosclerosis, 83.8 per cent showed improvement; of fifty-four cases of thrombo-angiitis obliterans, 79.6 per cent showed improvement.

3. The results show that arteriosclerosis is as amenable to this type of treatment as is thrombo-angiitis obliterans.

Problems of Posture

From the Standpoint of Etiology and Treatment
David Silver, M.D., Pittsburgh, in Calif. & West. Med., 40:10:809, July 1937.

The importance of correct posture to man's health, efficiency, appearance, and economic opportunity needs no discussion.

Trunk Posture

Of prenatal factors influencing correct posture, visceroptosis only need be mentioned. During infancy and extending on into early childhood development changes are taking place. If they deviate from normal lines, they may lead to postural defects. The single long posterior curve presented by the spine at birth gradually breaks up into the segments necessary for balance in the upright position, and the spinal muscles slowly acquire the strength required to support these curves. The abdominal muscles, which furnish the essential accessory reinforcement to the spinal muscles in maintaining a correct attitude, go through a relative readjustment and increase in strength to meet the approaching functional demand.

The resistance which is afforded by the abdominal wall to the descent of the viscera influences the action of the diaphragm most markedly. Were the resistance offered by both the wall and the viscera entirely removed, it is evident that the action of the diaphragm would be exerted in drawing the lower ribs inward and so diminishing the size of the lower thoracic cavity. An almost total loss of resistance is seen in extreme degrees of visceroptosis, and in some of these a loss of diaphragmatic action has been demonstrated by radiographic examination. The striking effect of this loss of resistance on the body posture is well known. If, on the other hand, the resistance of the abdominal wall is markedly increased by extreme forced contraction of the abdominal muscles, the abdominal viscera are forced upward into the lower thoracic cavity and act as a fulcrum over which the diaphragm contracts and lifts the entire thorax, thus giving the impression of a marked costal expansion and producing an over-erect figure. The enormous chest expansion seen in many professional athletes is obtained in this way. A study of these extremes shows clearly the prominent part played in normal respiration by the abdominal wall and clearly indicates its importance to correct posture. Moreover, it must not be forgotten that control of respiration is partly voluntary, it being possible not only to vary its limits, force, and rhythm, but also, which is a point of special importance to our subject, to use the rib-lifting muscles and the diaphragm to a very definite degree independently. Thus, the correction of an improper method of breathing becomes a simple matter of muscle re-education, as every teacher of singing and elocution knows by experience.

Fatigue as a Factor

The importance of this factor of fatigue is clearly indicated by the marked improvement in posture so frequently observed after a few days of complete rest in bed in the correct position. Unfortunately, with the advent of childhood the regular routine for rest carried on during infancy soon begins to be broken and is frequently discontinued as early as the end of the second or third year.

Effect of Unsuitable Chairs and Other Seats

Chairs and other seats of unsuitable design and size for children are still the rule. Small chairs for very young children are found in practically all homes; but when they are outgrown, those of intermediate size are rarely provided and, hence, regular adult chairs must be used.

The chief fault of the adult chair from the standpoint of the child's requirements is its deep seat, which is especially pronounced in the present day large over-stuffed chairs and lounges. In order for the child's back to find support in the adult-sized chair it must bow sufficiently for the shoulders to reach the back of the chair. Sitting for longer periods in such a position may disturb muscle balance to a harmful degree and thus act as a factor in faulty trunk posture. The same fault is found in the automobile seats used in the larger cars, and the harmful effect is aggravated by the constant jarring incident to automobile riding.

Faulty Leg and Foot Posture

In faulty leg and foot posture, as far as predisposing prenatal factors are concerned, those distortions of the extremities resulting probably from increased intrauterine pressure are the most important. Certain of these, such as bow-legs and pes calcaneovalgus show some tendency toward natural correction although this is apt to be incomplete; but the majority are more likely to be aggravated by growth. Hence, if neglected, they become predisposing causes of postural defects the end of the second or third year.

Unsuitable Shoes

Shoes play the chief role in the etiology of foot troubles of static origin. Feet are of two main types—the inflared and the straight. The former is broader, the arch is lower, and the line bisecting the heel passes through the fourth toe. The latter is slender, particularly at the heel, the arch is high, the forefoot fan-shaped, and the line bisecting the heel passes through the middle toe. About two-thirds of the feet are of the former type and one-third of the latter.

Years ago shoes were made on lasts which conformed to the shape of the latter or straight type of foot. The boots of our forefathers could be and were worn on either foot. It is said to have been the custom, when removing them at night, to place them in the reversed position so as to insure their being worn reversed the next day. Then the inflared or so-called orthopedic last was introduced to meet the demand of a larger class, who at that time obviously were the chief sufferers from unsuitable shoes. Gradually the straight last has been virtually discontinued until it has become difficult to get children's shoes in which the straight type of foot can function properly. Thus it has come about, at least in the experience of some of us, that the feet which present most of the foot difficulties today are those of the straight type with the narrow heel and relatively broad fan-shaped forefoot. If a straight last shoe is put on an inflared type of foot, the foot will be forced toward pronation; whereas if an inflared last is worn on the straight type, the foot will be forced toward varus with resulting undue prominence of the base of the fifth metatarsal bone, and the fourth and fifth toes will be flexed and forced under by pressure from the outer side of the cap and the vamp. In the straight type the extreme disproportion between the width of the foot at the heel and across the toes makes it impossible in the present commercial shoe to get sufficient room for the outer toes while still gripping the heel properly, even in the broad-toed type of child's shoe.

Treatment

In treatment, attention must be given first of all to these fundamental factors. It must be borne constantly in mind that the correct method of natural functions, among which are these of breathing and of standing and walking, is not necessarily acquired naturally and, even when so acquired, is frequently lost later in various ways; also, that only through a thorough understanding of the correct method can the incorrect be recognized. The significance in modern life of fatigue as a factor in all the affections of childhood needs to be fully appreciated and measures for its precaution instituted. The design and fitting of body coverings must be studied from the viewpoint of the elimination of all restriction to function. Finally, it must be recognized that through muscle re-education, although some cases tax the skill of even the best physical therapeutists, the majority will respond quickly to the basic measures given in the following outline.

Therapeutic Exercise

Madge C. L. McGuinness, New York, N. Y., M. Rec. 145:10:407, May 19, 1937.

Pelvic disabilities—Functional disturbances can be greatly helped by exercise which equalizes the circulation, corrects uterine malpositions and develops the muscles of the abdomen and perineum. Proper body mechanics will do much to correct the pain, menorrhagia, amenorrhea, dysmenorrhea, metrorrhagia, headache, backache and excessive fatigue. Many of the usual complaints that disable the girl and the woman through the whole of her life are due to lack of proper exercise in the period between twelve and twenty years. Here is one of the greatest fields for preventive medicine. Girls should not enter sports with the idea of making records. For them the recreational aspects are much to be preferred.

For the weak, anemic girl or one of inferior constitution, graded exercises in conjunction with massage, baths, or better, under-water exercises such as swimming, will do much to develop health and strength, to insure a proper pregnancy and prevent hard labors that usually leave this type of woman an invalid all her life. Pregnancy is no contraindication to exercise, in fact, it is just the opposite, and exercise should be continued until parturition.

For the relief of backache, the knee-chest position for ten minutes twice or thrice daily is excellent. As this is monotonous, we usually instruct the patient to act as would an angry cat or a dog wagging its tail or a camel humping along in the desert, and then have her finish up by walking on all fours like a bear.

Backache caused by retrodisplacement or uterine prolapse will be helped by the knee-chest position and separating the labia to allow air to drive forward the uterus. If this be done at night and the patient then sleeps on the abdomen, in ordinary cases, symptoms will soon disappear and severe ones should be greatly relieved.

In dysmenorrhea, exercises are to be taken thrice daily for ten minutes between periods until there is quite a decided improvement, then for two weeks, and lastly for one week. They consist of the following: (a) The knee-chest with variations. (b) Lie on the back, knees up, by deep breathing see how high and how low the abdomen can be moved. Complete relaxation. (c) Contract the gluteals, inhale deeply, exhale by pulling up the abdomen sharply. Relax. Repeat three, five, ten times. (d) Walk on all fours.

Proper body mechanics and an outdoor walk of at least two miles daily are the best preventive and corrective methods for pelvic disabilities.

Underwater Exercises

A leading article in The Lancet, CCXXXIII:5942:143, July 17, 1937.

It has long been known in hydrotherapeutic establishments and elsewhere that patients with stiff joints or partially paralyzed muscles can carry out exercises in a bath which they would be quite incapable of executing outside it, and the experiments of Crowden at the British Red Cross Society's clinic in 1935 gave striking proof of this. He found that a man who was exhausted in two minutes by a certain exercise carried out on land could continue the same exercise almost indefinitely in water; in executing a simple arm-bending or leg-bending exercise the increase in oxygen requirement over the resting level was about twice as great in air as in water, and with a trunk exercise the proportion was about three to one. The explanation of this is, of course, that the buoyancy of the water supports a large proportion (about 19/20ths) of the body weight, and although the moving limbs encounter greater resistance the work done against gravity is almost abolished. It follows that if only a small fraction of its power remains in a paralyzed muscle, this may still suffice to produce susceptible movement in a limb which is immersed in water. The warmth of a bath too may do much to allow of movement in a spastic limb by reducing spasm and the resulting pain. To a certain extent exercises can be carried out in an ordinary bath, but they must of necessity be limited to the limbs, and where the trunk and neck are to be exercised, the use of a swimming bath is essential. The latter has the advantage that it permits of several patients being supervised simultaneously by one attendant, but far more important is its effect on the patient's mind. What a paralyzed person wants above all is to be able to move about without assistance, and this he may very well be able to do in a swimming bath, even though he may need help if he is to take a step outside it. The enthusiastic co-

operation of the patient which this ensures contributes largely to the success of the treatment, especially where return of function is a matter of reeducation.

In England the hot and buoyant waters of Droitwich are famous for their power to restore movement to painful joints and strength to wasted muscles; and our own Premier has remarked that it is well worth while to get an attack of rheumatism or lumbago in order to experience the comfort of a bath in them. At other British spas, notably at Bath, the "hot pool," which is large enough to permit of free movement, is in constant use; where necessary the patient is lowered into the pool by means of a sling. But much is also possible without the natural advantages of a spa, and in the last two years clinics for this form of therapy have been opened at the Rudolf Virchow Hospital in Berlin and at the Lainz Hospital in Vienna. Scholtz in Berlin reports that he has treated some fifty patients with results that he describes as striking, including cases of spastic and flaccid paralysis from disseminated sclerosis, vertebral lesions, poliomyelitis and polyneuritis. In tabetics he did not find the method so useful. Urban in Vienna has treated a further series of cases of similar type, also with satisfaction, though he advises particular care in cases of disseminated sclerosis and progressive muscular atrophy and those in which the patient's general condition makes exertion dangerous. Incidentally he remarks that a considerable strain, both mental and physical, is placed upon the attendants. He has also done some interesting research on what he calls the "swimming phenomenon," based on the observation of Luciani in 1893 that dogs rendered ataxic by cerebellar avulsion could swim though they could not walk. He found that four patients with advanced cerebellar ataxia due to disseminated sclerosis, who could neither walk nor stand on land, could swim with astonishing efficiency, and that their ataxia was scarcely noticeable in water; whereas patients with ataxia from extracerebellar causes could not swim, even though their walking was improved by immersion.

Physical Therapy in the Hospital

Frank H. Krusen, M.D., Section on Physical Therapy, The Mayo Clinic, Rochester, Minnesota. In Hospitals, 11:8:54, August 1937.

Number of Physical Therapy Departments

In 1927 Peebles reported that of the 7,000 hospitals in the United States, 2,100 had physical therapy departments as compared to 4,400 which had clinical laboratories and roentgen ray departments. Kovacs reported that in 1931 there were in the United States 2,236 physical therapy departments as compared with 4,523 roentgen ray departments. He further stated that a survey of the New York State Hospitals in 1930 showed that 57 per cent possessed physical therapy departments and that 34 per cent of the remainder were planning to organize such a department.

Conclusions

The department always should be headed by a physician who has been trained in the field and who should assume *direct* supervision of the work.

The technicians who serve under his supervision should be registered by the American Registry of Physical Therapy Technicians.

The department should have ample floor space, should be easily accessible to other divisions of the hospital, and should be well lighted and ventilated. (It is preferable not to place this department in a basement.)

The equipment should be carefully selected, and only apparatus which has been approved by the Council on Physical Therapy of the American Medical Association should be used.

Proper record forms, which give ample information concerning the condition of the patient on admission to the department, treatment administered, progress made, and condition on dismissal, should be provided.

The department should be conducted on an appointment system, and, in most instances, should be open all day.

It should be realized that one technician is capable of administering no more than fifteen to twenty treatments per day.

It should be realized that, when properly organized, the department can be self-sustaining or more than self-sustaining.

The department should receive only those cases which have been carefully studied and diagnosed in the clinical section of the hospital (no case should originate in the physical therapy department).

The medical director of the department should, after consultation with the referring physician, be permitted to modify treatment as he feels advisable.

Technicians should never be permitted to administer any treatment without a specific written order from the medical director of the department.

The treatment rooms should be properly wired with sufficiently heavy wiring and fuses to accommodate the apparatus to be used. The electrical outlets should be placed on the wall, at about shoulder height, so that they are easily reached.

The department should be organized on a moderate scale, taking into consideration the needs of the particular hospital that it serves, and provision should be made for expansion.

In order to function properly, the hospital physical therapy department should be a distinctly separate unit, serving all other sections of the hospital equally, and it should not be made a subdivision of one of the medical specialties.

Properly organized, properly located, and properly staffed, the physical therapy department of the modern hospital will accomplish much in restoration of normal function, improvement of the patient's morale, shortening of his period of disability, and in the alleviation of human sufferings. It will prove a most valuable asset to the institution.

Experimental Studies on Specificity of Short Wave Diathermy

Heinrich F. Wolf, M.D., New York. In Arch. Phys. Therapy, XVIII:6:358, June 1937.

Conclusions

1. The alleged specific action is due to anatomic differences of the vessels.

2. Short wave diathermy of very small energy is capable of dilating only the very thin capillaries and precapillaries, but not the thick walled arteries, while high energies are strong enough to dilate the arteries and thus interfere with the capillary circulation.

3. Wavelength per se is of no specific importance from the clinical point of view.

4. Strong short wave diathermy does not differ essentially from conventional diathermy in its action.

5. Intensive infra-red radiations have—at least in some pathologic conditions—the same effect as strong short wave diathermy and conventional diathermy, so far as volume increase is concerned.

6. A basis is offered to explain why short wave diathermy of low energy is more efficient in the treatment of local infectious conditions than application of high energy.

7. The effect of low energies increases with the duration of individual treatments.

Constructed for the Cripple

Howard Wharton, in The Modern Hospital, 49:2:54, August 1937.

In few medical fields has scientific advance been so rapid as in the specialized field of pediatrics. Notable progress has been made in orthopedic surgery and in hydrotherapy, resulting in new techniques and treatment for the crippled child.

During the first three years of operation the Carrie Tingley Hospital will treat only New Mexican children. A survey has disclosed that more than 1,200 are in need of treatment. The hospital, dedicated on May 29, 1937, was occupied in June. The staff at capacity includes seventy-five persons. Dr. F. C. Goodwin, specialist in orthopedics, is the chief attending surgeon. A dentist, general surgeon, attending staff and pediatrician have been appointed.

Administration reception rooms, sun porches and recreation room are built around a patio. Hospital units are in the wings. There are numerous terraces and porches for sun baths, two cast rooms, occupational therapy rooms, operating rooms, and auxiliary rooms, an infirmary unit attached to the operating wing and treatment rooms.

The large outdoor swimming pool is enclosed on four sides. Connected with it are an enclosed treatment pool, tub rooms, rest and physical therapy rooms.

The Morris Memorial Hospital for crippled children is under construction at Milton, W. Va. When completed the hospital will cost approximately $379,258. It is located on a farm and homestead deeded by W. T. Morris in perpetuity for the care and hospitalization of the crippled children of West Virginia.

The hydrotherapy building, designed to fit into the entire architectural scheme, is constructed of hard, blue-white native sandstone. Roof beams are of steel and the two pools, each 24 by 36 feet, are of stone and cement.

Salt water of the proper quality, so necessary to the relaxation and exercise of crippled limbs, is found near the hospital at approximate depths of 1,000 feet. Being slightly heavier in salt content than that found on the Atlantic Coast, this water has excellent buoyancy. The water is piped from artesian wells to the hospital where it is heated before it is used in the pools.

In addition to the large pools, the hydrotherapeutic building contains a smaller pool or tank in which spastic paralysis cases can be treated. The arrangement and size of the pool permits the attendants to assist in supporting these almost helpless patients. By relaxing in water much hotter than that of the other pools, the nervous jerking of the spastic-paralytic often is reduced sufficiently to permit control of the muscles.

Another hospital for crippled children has been built by WPA at Knoxville, Tenn., aided by the American Legion, the Shrine and Knox County. The land for the site was contributed by Fort Sanders Hospital, the facilities of which have been available for crippled children in emergencies.

The new hospital includes a therapeutic pool, similar to the Warm Springs pools, a violet-ray room, dietetic kitchen, school room and a glass examination room. The glass examination room was decided upon in order that frightened children, facing an operation, can see cheerful patients who are recovering from the same ordeal.

Another project, an addition to the Betty Bacharach Home for Crippled Children at Longport, N. J., has just been completed by the WPA. Its therapeutic pool with a capacity of 15,000 gallons is constructed of white tile and has a skidproof bottom. The pool is 12 feet wide and 22 feet long. Sterilized sea water will be changed every three and one-half hours. Physical therapists will treat patients in the pool on stainless steel apparatus.

The addition also contains four treatment rooms, four dressing rooms, an office, consulting room, rest rooms and cubicles. A sunlight room with a carbon lamp treats a dozen at one time.

The Treatment of Erysipelas

M. J. Fox, M.D., Milwaukee. In Wisconsin M. J., XXXVI:7:528, September 1937.

Light and Moderate Cases

Much misunderstanding exists with respect to the light and moderate cases. The only cases that are of importance from the standpoint of specific therapy are the moderately severe, severe, and malignant types.

The ideal treatment is a combination of serum, the ultra-violet ray, and Burow's solution (chart 7). Serum is not necessary in mild or moderate cases and its use is, therefore, wasteful.

Our hospital records show that the serum-treated cases have the longest stay in the hospital. The use of the antitoxin seemed beneficial only in the severe types of erysipelas. Added to the antitoxin were the ultra-violet treatment and local application of Burow's solution. It is my opinion that mild cases need have only local application of Burow's solution, that the moderately severe cases may be treated with ultraviolet and Burow's solution. In severe infection with high fever, bleb formation, and rapidly spreading lymphangitis, the triad of serum, Burow's solution and ultraviolet rays gives the best results.

Summary

Analysis of 378 cases of erysipelas reveals that 89.1 per cent were facial. The mortality rate was 9.52 per cent. The mortality rate of cases treated with serum was 8.8 per cent. The average number of hospital days was 9.9. The average number of hospital days of patients receiving serum was 11.2, while those not receiving serum was 8.26. The mortality rate was greatest in the malignant cases, but of importance in the interpretation was the 19.5 per cent death rate in the clinically severe types of cases.

Conclusions

1. Mild and moderate clinical types of erysipelas respond to any of the empirical measures.

2. Thirty per cent of the severe cases of erysipelas have an improved mortality rate resultant to the early introduction of specific therapy.

3. Human convalescent scarlet fever serum is useful in the therapy for erysipelas.

4. From all available data and my own experience, the use of (a) antitoxin intra-muscularly, (b) ultra-violet rays, (c) local application of Burow's solution, and (d) chemotherapy, is recommended.

Action of Carbonic Acid Baths

Abstract in J.A.M.A., 108:24:2082, June 12, 1937, from Presse méd., 45:469, March 27, 1937.

A carbonic acid bath when taken at a temperature of 91.5° F. lowers the systolic and diastolic blood pressure during the first few minutes and later raises it. It brings about a dilatation of skin capillaries, retards the pulse and increases the diuresis. André investigated its action on general metabolism and peripheral circulation. He had seven subjects between the ages of 24 and 47 years on whom he conducted his experiments, choosing about four hours after the last meal as the suitable time. He observed that the volume of expired air was increased 23 per cent. If the respiratory quotient was 0.88 before the bath, it rose to 1.16 during the bath. The average metabolic rate was increased 9.5 per cent during the bath. Briefly, a carbonic acid bath at 91.5° F. accelerates the peripheral circulation through absorption of carbon dioxide through the skin and its elimination by expiration. A bath of tap water of the same temperature tends mostly to slow down circulation. The P_H drops from an average of 7.41 to an average of 7.38 and this is usually accompanied by a surplus of carbon dioxide in the blood (from 50.89 to 53.36 per cent). In spite of this drop of $_pH$ the average rate of oxyhemoglobin is raised from 82.5 to 86 per cent. The main argument against these figures would be the possible inhalation of carbon dioxide given off by the bath. But the author provided his subjects with pure air from without by hyperventilation and the figures obtained were the same. It is essentially the anhydride of the carbonified water, which, penetrating the immersed skin, increases the carbon dioxide contents of the venous blood.

Action of Carbonic Acid Baths

E. Ehrenpreis Polska Gazeta Lekarska, Lwow, 16:399 (May 23, 1937). In J.A.M.A., 109:2:178, July 10, 1937.

Ehrenpreis says that the hydrostatic pressure of carbonic acid baths exercises the same influence as that of ordinary baths and that the action of the baths depends on the temperature of the water. The baths not only regulate but also sustain the uniformity of temperature of the body. But there is a difference in the case of carbonic acid baths, which have a distinct influence on the organism of the patient through the specific action of carbonic acid. Many times he has observed objective and subjective improvement in patients with heart disease who went to a gaseous mineral water health resort for five or six weeks just to change their environment. A remarkable fact is that during their stay at the resort, usually by the end of the second week, the patients became worse and were generally weaker but noted great improvement during the third week. This temporary general debility at the end of the second week is called by German physicians "brunnenrausch." This debility is caused by gaseous air inhalations to which the patient's organism is not adapted. This observation proves that we are still in the dark as to the action of carbonic acid baths, although we know that carbonic acid acts especially on the skin by penetrating in different ways into the organism, and also acts on the heart. The indications and contraindications of carbonic acid baths in cardiac patients should be thoroughly investigated and their dosage as to temperature, intensity, time of application and frequency should be established by further study.

Peripheral Vascular Disease

Simple External Suction

Joseph Tenopyr, M.D., F.A.C.S., and B.G.P. Shafiroff, M.D., Brooklyn, from the Surgical Service, Kings County Hospital. In New York State J. Med., 37:15: 1387, August 1, 1937.

The purpose of this paper is to show that a simple suction device can be used in the treatment of peripheral vascular disease without the necessity of purchasing the expensive apparatus now on the market. The apparatus can easily be assembled in any hospital and can be more generally used by the profession with the knowledge that the same physiological benefits can be obtained as with a commercial pattern. It consists of the regular portable suction machine used for surgical aspiration connected to an airtight chamber, or boot, by rubber tubing. A small expenditure is involved in the construction of the boot. We used three boots, two of which were made of a rust proof tin and one was made of a grade one wood fitted with windows. These can be readily made by a carpenter or tinsmith according to specification. Before the extremity is inserted into the boot, a properly fitting non-constricting rubber tube encircles the leg or thigh. These tubes resemble in appearance the inner tube of an automobile tire and are of various sizes. They are home made but are so constructed that on inflation the proximal circumferential rim is fixed while the outer rim can be expanded distally to fit snugly into the end of the boot.

Painful Coccyx

In J. A. M. A., 109:4:309, July 24, 1937, from Arch. of Surg., 34:1088, by G. A. Duncan, Norfolk.

Duncan states that from 1924 to 1934, 278 (97 per cent were women) patients were admitted to the outpatient department of the New York Orthopedic Dispensary and Hospital with the complaint of pain in the coccyx. The average age was thirty-four years. The most common cause of the fall in this group of patients was slipping on an icy pavement and landing in the sitting position. The interval between the time of injury and the time of the patient's admission to the hospital for treatment varied from three days to six months. Nonoperative treatment consisted of improving the patient's posture, having her sit erect and pull the buttocks in under the trunk, thereby taking the superincumbent body weight off the coccyx and causing the soft parts surrounding the coccyx to act as a natural cushion. Hot sitz baths for from twenty to thirty minutes twice each day proved of value. Constipation, when present, was relieved by suitable laxatives. Local massage has proved beneficial to many of these patients. Steady but firm stretching of the coccyx posteriorily has been done on patients for several consecutive visits, with relief from pain. This is done to overcome the spasticity of the muscles having their insertion on the coccyx and to prevent the formation of adhesions and contractures in the sacrococcygeal joint and the surrounding coccygeal structures. Local injections of from 70 to 80 per cent alcohol, physiologic solution of sodium chloride or 2 per cent solution of procaine hydrochloride have given only transient relief or were entirely unsatisfactory. Of the 248 patients treated by nonoperative methods, fifty-four were examined from one to four years after the onset of their coccygeal pain. Only two continued to complain of a painful or tender coccyx. Fusion of the sacrococcygeal and interococcygeal joints had taken place in a large

number of the patients, and in the remainder there was limited motion. This limitation of motion in the coccygeal joints, coeval with cessation of pain, is additional evidence that the coccygeal pain was coming from a lesion of the joint. Injection of alcohol about the coccyx may not cause degeneration of the coccygeal nerves, but by causing scar tissue to form it may so limit motion of the coccyx that the pain is diminished or cured. In the two patients who continued to complain of coccygeal pain, motion at the sacrococcygeal joint caused an identical pain. Relief from pain was experienced within one month after the injury by thirty-six of the fifty-four patients, by eleven within two months and by five within six months. The results seem to indicate that the nonoperative form of treatment should be tried for a period of six months before operative resection of the coccyx is resorted to.

Thirty of the patients in the total group had operative resection of the coccyx. The average duration of their symptoms before resection of the coccyx was eighteen months. Patients were followed on an average for two years after coccygectomy. Twenty-two of these patients were relieved completely of coccygeal pain, three had only partial relief from pain and five were unimproved.

Alar Scapula

Traumatic Palsy of Serratus Magnus

E. J. Berkheiser, M.D., and Fred Shapiro, M.D., Chicago, J.A.M.A., 108:21:1791, May 22, 1937.

Treatment

Thomson and Miles advised conservative treatment, consisting essentially of strychnine, muscle and nerve tonics (?), massage and faradic stimulation. They suggested the mechanical use of a padded belt for pressure over the scapula to maintain the scapula against the thoracic wall. They consider two methods of operative intervention: (1) transplantation of the latissimus dorsi over the inferior angle of the scapula to diminish the deformity, and (2) transplantation of the clavicular origin of the pectoralis major to the serratus magnus or the axillary border of the scapula.

Skillern treated one case by rest, massage and strychnine and after three months, when no improvement was noticed, advised operative measures. He formulated a procedure whereby the proximal end of the short subscapular nerve was to be anastomosed to the distal end of the sectioned long thoracic nerve of Bell. This procedure was not attempted, as far as we could determine from the literature.

Gower advised the use of an airplane type of splint, faradic stimulation, massage and muscle training. If these measures did not give results, he stated that the operative procedures advocated by Thomson and Miles or Skillern should be attempted. He reported one case with a successful outcome under conservative measures and four cases with no improvement. He does not state whether operation was performed in any of the unimproved cases.

Eshner suggested treatment by massage and electricity.

The four cases that we are reporting were not treated with any of the aforementioned medicinal measures, which undoubtedly would have been worth while adjuncts to the treatment instituted. These reported cases were treated by constant immobilization with the arm held so as to relax the serratus magnus muscle. In this position the scapula was held closely approximated to the thoracic wall and this position was maintained by a plaster shoulder spica cast. It was found that a period of three months was necessary for the return of function to the nerve which was manifested by the ability of the muscle to maintain the scapula in its normal position. After the return of function, physical therapy aids materially in restoration of muscular strength and mobilization of the joints of the upper extremity. All four patients recovered complete function with this method of treatment.

The Compensation Aspects of Low-Back Conditions

Howard L. Prince, M.D., Rochester, N. Y., in J. Bone & Joint Surg., XIX:3:805, July 1937. (Read at the Annual Meeting of the American Academy of Orthopedic Surgeons, Cleveland, Ohio, Jan. 14, 1937.)

It is upon the first medical man who sees the injured back that much of the responsibility for the after-result falls. I believe that all of these backs should be rested. Frightening the individual or fixing in his mind that he has a serious back injury should be meticulously avoided. Strapping the back and urging the patient to return to work as soon as possible, are, I believe, the causes of much of our difficulty in later cases, in spite of the statement of the head of one of the insurance companies that he is impressed by the better results that osteopaths obtain because they minimize the condition and do not frighten the injured man into feeling that he has a serious lesion. Strapping and a few days rest on a hard bed with the application of a little local heat—perhaps relaxing the patient completely with morphine for the first forty-eight hours—will enable the patient to get back to work when he feels that he can. He has a feeling of being well cared for and his inclination is to return to work. The psychological character of the individual, as well as his physical condition, should be taken into consideration in every case. If the injury has occurred to a spine already showing the ravages of hypertrophic arthritis, due consideration to that fact must be given. In compensation cases, I am continually struck by the importance of keeping the attitude of the patient right. The doctor may not be able to do this; fancied injustices on the part of the employer may make it very difficult.

The application of casts and the use of braces, I believe, are fraught with peril. Certainly before employing either form of treatment, one should be very sure that the advantages to be gained will outweigh the possible harmful effects on the patient. It is always well to look back and realize that casts and braces, which were believed in so thoroughly by the older generation, have, in most instances, failed to accomplish what they were supposed to have done. I often think of the situation in regard to scoliosis,—men wrote books on the treatment and cure of scoliosis, illustrating plaster jackets and braces that pressed here and pulled there, but, on final investigation, no case of cure was shown.

When it comes to the question of the need or the advantage of surgery in the low-back conditions, we should deliberate most carefully, because, if we give certain types of individuals a scare, they will never get out of the compensation class.

Book Reviews

TECHNIQUE OF UNDERWATER GYMNASTICS. By Charles LeRoy Lowman, M. D., F. A. C. S., Chief of Staff and Director of Educational Activities, Orthopedic Hospital, Los Angeles; Susan G. Roen, Graduate, Sargent School of Physical Education, Director of Physical Therapy Department, Orthopedic Hospital, Los Angeles; Ruth Aust, B. S., University of Washington, former Physical Therapist, Orthopedic Hospital, Los Angeles; University of California Hospital, San Francisco; now at Children's Hospital, Denver; and Helen G. Paull, B. S., University of Wisconsin, Physical Therapist, Dr. Lowman's private gymnasium. Cloth. Price, $5.00. Pp. 270. Sponsored by Los Angeles Orthopedic Foundation. Los Angeles: American Publications, Inc., 1937.

Lowman is recognized as an authority in the field of hydrogymnastics. The Council on Physical Therapy of the American Medical Association in one of their articles on aids in muscle training state that while underwater exercises are suitable for infantile and other types of paralysis, chronic arthritis and weakness and stiffness of the extremities after injury, this type of exercise will also be found useful in many instances in the field of internal medicine, neurology and psychiatry. The authors, in the section on conditions suitable for hydrogymnastic treatment, discuss their personal experiences with the aforementioned classes of cases.

There are also valuable sections on the construction and physical equipment of pools, the arrangement and administration of a hydrogymnastic department and the field of application of corrective aquatics.

Permanent or fixed pools or portable tanks may be used for therapeutic purposes. This volume considers mainly underwater exercises in large pools. Part two on the general theory of the use of underwater gymnastics is of special interest to physical therapists. In this section there are chapters on the general theory of the use of underwater gymnastics, the theory of pool technic, general applications, fundamental positions and nomenclature, deformity prevention and correction. Three of the four authors are physical therapists, and this book can be recommended to anyone in this profession as a complete work on the technic of underwater gymnastics.

JUVENILE PARESIS. By William C. Menninger, M. D. The Menninger Clinic Monograph Series No. 1. Cloth. Price, $3.00. Pp. 199, with 16 illustrations. Baltimore: The Williams & Wilkins Company, 1936.

This is a monograph in which the author has collected a series of his studies of juvenile paretic neurosyphilis previously published in various medical journals. In addition he has given an excellent resume of the more important literature on the subject. Although the actual incidence of juvenile paresis is rare, it occurs frequently enough to warrant adequate recognition and early treatment. Chapters deal in order with the incidence, sex and age at onset, family history, developmental history, the organic neurologic signs and symptoms, physical complications, stigmas, endocrinopathies, the mental picture, laboratory findings, clinical course, treatment and pathology. Should one desire any information on juvenile paresis, it is quite likely to be found in this well-arranged and informative presentation.

THE RIDDLE OF WOMAN: A STUDY IN THE SOCIAL PSYCHOLOGY OF SEX. By Dr. Joseph Tenenbaum. Cloth. Price, $3.50. Pp. 477. New York: Lee Furman, Inc., 1936.

In this day of the "emancipated woman" the new problems which have arisen harken back to those problems of the past, for the woman question has existed since the creation of Eve. She has had paramount roles throughout the history of art, literature, music, science, and economics. "Cherchez la femme" has resounded through the ages in man's conquest of the universe, and yet she has been stigmatized as the weaker sex, bearing her cross in silence. As a result there has evolved a complex emotional and psychologic creature. The author attempts first to define woman as a biologic entity. Recognizing her essential sexual nature, he traces the development of her sex psychology from primitive days to the present difficult period of civilization. The early concept of woman's role in life ascribed to her the primary purpose of procreation. The development of marriage gave her greater significance, but with that arose the problems of the bride, the mother, the unmarried wife, the adulteress, the divorced wife, the widow, the virgin and the spinster. These problems are dealt with in separate chapters and are presented in such a manner as to make exceedingly interesting reading. The author's frequent reference to historical records and to psychologic and sociologic investigations gives considerable worth to the material presented. A chapter on woman in industry, commerce and professions reveals a new source of problems in view of the need for emotional adjustments.

Any information which contributes toward a better understanding of the basis of woman's behavior in health and in illness is indeed valuable. She deserves it.

HYPNOTIC POWER: ITS CULTIVATION, USE, AND APPLICATION TO PSYCHOTHERAPY. By Colin Bennett. Cloth. Price, $1.50. Pp. 158. New York: E. P. Dutton & Co., Inc., 1937.

Most human beings are notoriously hypersuggestible. This fact was recognized by the ancient philosophers fully as much as by modern psychologists. The old association of illness with disturbance of bodily fluids, of animal spirit and supernatural currents resulted in a correspondingly bizarre form of treatment. Thus hypnotism had its origin in the days of ignorance. Under the leadership of Mesmer a school of hypnotism developed and reached a degree of scientific usage chiefly in the hands of Charcot and Bernheim. Had it not been for the discovery of ether, it is quite likely that use of hypnotism to produce anesthesia would have reached a much wider acceptance. Instead, hypnotism of today is cloaked with an air of mysticism and "black-wizardry." Its exhibition on the stage by the magician has been primarily to entertain a curious audience. In medical practice, however, it is frequently employed by the psychologists, particularly, in the treatment of hysteria. A careful treatise on so interesting a subject would be highly desirable. Bennett's book, however, is certainly not the answer. He presents hypnotism rather as a subject for "parlor entertainment" in which it certainly has no place. The short historical resume which appears in the first part of the book may have some merit. The rest of the material, however, is poorly presented and can scarcely be recommended to anyone with the medical point of view.

RECENT ADVANCES IN THE STUDY OF RHEUMATISM. By Frederic John Poynton, M. D., F. R. C. P. (Lond.) Consulting Physician, University College Hospital and the Hospital for Sick Children, Great Ormond Street; and Bernard Schlesinger, M. A., M. D. (Camb.), F. R. C. P. (Lond.), Physician to the Children's Department, Royal Northern Hospital; Physician to Outpatients, Hospital for Sick Children, Great Ormond Street. Second edition. Cloth. Price, $5.00. *Pp.* 380, *with* 51 *illustrations. Philadelphia: P. Blakiston's Sons & Co., Inc.,* 1937.

This book is one of the "recent advance" series, the first edition of which appeared in 1931. The authors state that this small book is not a textbook upon rheumatism but is a judicial review of the recent literature on rheumatism. There are two parts: the first, considering acute rheumatism, discusses the causes, pathology, bacteriology, tonsillitis and rheumatism, the allergic factor in rheumatism, electrocardiography in acute rheumatism, preventive treatment and immediate treatment. The last chapter of part one is on the convalescent treatment. This is of interest to physical therapists because it describes the construction and administration of convalescent homes especially adapted for children recovering from a recent attack of rheumatic carditis. It also gives a system of graded exercise for children with rheumatic heart disease.

Part two considers chronic rheumatism. One of the first chapters is on the industrial aspect of rheumatism and gives most of the recent data concerning the subject collected in countries abroad. In this section there is a chapter on physical therapy by Frank Howitt, C. V. O., M. D., F. R. C. P., who emphasizes that it should be fully realized that dosage and technique are as important in physical therapy as in the case of drugs and other therapeutic measures, and that overdosage may be equally harmful.

SHORT-WAVE DIATHERMY. By Tibor de Cholnoky, M. D., Associate in Surgery, New York Post-Graduate Medical School, Columbia University. Cloth. Price, $4. *Pp.* 310, *with* 38 *illustrations. New York: Columbia University Press,* 1937.

Many exaggerated claims have been made for the therapeutic value of short-wave medical diathermy. The author in his concluding chapter calls attention to the fact that short-wave diathermy may be considered purely a form of heat therapy, superior to other forms of heat because of its deep action. It is emphasized that the dosage is as yet uncertain.

This conservative attitude is not followed in the part on the clinical applications of short-wave diathermy. In this section there are suggestions for treatment based on the investigations of European workers in such conditions as pulmonary tuberculosis, diabetes mellitus, bronchiectasis, emphysema, empyema, abscess of the lung, and pulmonary gangrene. The records of success in the treatment of these conditions are not convincing. It would seem that this volume would not be of service to the general practitioner because such radical treatments should be administered only by the experienced physician. It has a definite value to the specialist in physical therapy as it gives an excellent survey of the laboratory and clinical work in short-wave diathermy with a complete bibliography.

THE INTELLECTUAL FUNCTIONS OF THE FRONTAL LOBES. By Richard M. Brickner, B. S., M. D., Assistant Professor of Neurology, College of Physicians and Surgeons; Attending Neurologist, Neurological Institute, New York. Cloth. Price, $3.50. *Pp.* 332. *New York: The Macmillan Company,* 1936.

To the frontal lobes of the brain has been ascribed the important function of intelligence. Memory, reason, judgment and other attributes which differentiate man from lower animals are presumably housed in this portion of the nervous system. Clinical and experimental evidence, however, have yielded a variety of interpretations. On the one hand the frontal lobe has been termed the "silent area" of the brain inasmuch as its extensive destruction in some instances has given rise to very few symptoms. On the other hand small lesions involving this area have been found to give rise to severe disturbances of behavior. Brickner's unique experience of studying a human being in whom both frontal lobes were removed is, indeed, worthy of careful consideration. This is the only such case on record and the painstaking and excellent neurologic and psychologic studies carried out offer some exceedingly valuable information.

Most of the material presented is in the form of conversation, giving verbatum the responses of the patient to questions and situations in his every-day life. The author attempts to interpret these responses in an unbiased and objective manner. It is indeed surprising how little interference with intellectual function was manifested through the patient's behavior. The author concludes that none of the patient's symptoms indicated an alteration in the fundamental nature of any mental process but only the impairment of its completeness. The changes were essentially not qualitative but quantitative in nature. Some disturbance in the ability of the patient to synthesize thought processes was, however, evident. There was very little disturbance of affect or emotion. The chief function of the frontal lobes has to do with associations between engrammes rather than any specific guardianship over intelligence. This book is, indeed, a valuable contribution to our present knowledge of the intricate functions of the human brain.

AN INTRODUCTION TO DERMATOLOGY. By Richard L. Sutton, M. D., Sc. D., LL. D., Professor of Dermatology, University of Kansas, School of Medicine, and Richard L. Sutton, Jr., A. M., M. D., Instructor in Dermatology, University of Kansas, School of Medicine. Third edition. Cloth. Price, $5.00. *Pp.* 655, *with* 299 *illustrations. St. Louis: C. V. Mosby & Co.,* 1937.

This book is a condensed form of the eighth edition of Sutton's "Diseases of the Skin" which has been brought down to date. It is intended primarily for medical students and attempts to place emphasis on the fundamentals of dermatology rather than to amass a large amount of descriptive and statistical material which is usually found in larger works. It is the authors' intention "to sift, to cull, to condense, and then to offer the essentials upon which a sound knowledge of dermatology can be built." The photographs are of excellent quality, showing detail very clearly, and add greatly to the attractiveness of the book. The first eighty-five pages are devoted to fundamental and generalized consideration of dermatology rather than specific diseases per se. The rest of the book takes up the different skin diseases

according to a classification which shows the relationship of the diseases to each other. While only very brief paragraphs are used in the description of the rarer and more unusual skin conditions these descriptions are unencumbered and to the point. Histopathology, where not omitted, is limited to the most prominent changes. Differential diagnosis is considered under diagnosis, but the student will probably need to refer to a larger work for more complete details. The treatment of the individual diseases has been summarized, often into a single paragraph, omitting many of the details. Exclusive of x-ray, very little is said about the use of physical therapy, and no technique is given. The book is decidedly sound and conservative and speaks with such definite authority that it should be of interest even to the specialist. From the standpoint of the physical therapist it should be of interest, in addition, because of its clear descriptive style, its lack of heavy detail, and its clear illustrations. While the physical therapy technician would probably find considerable difficulty in attempting to apply the treatments recommended, this simple presentation of such a complex subject certainly would be of definite interest.

TRAUMA AND DISEASE. Edited by Leopold Brahdy, B. S., M. D., Physician in Charge of Industrial Diseases and Accidents in the Office of the Corporation Counsel of the City of New York; and Samuel Kahn, B. S., M. D., Medical Examiner in the Bureau of Workmen's Compensation of the Department of Labor, State of New York, New York City. Cloth. Price, $7.50. *Pp.* 613, *with* 9 *illustrations. Lea & Febiger,* 1937.

The controversy about the etiological relationship between trauma and disease has attracted attention since the establishment of workmen's compensation boards. On the one side is the workman and his personal physician usually overestimating the role of trauma, and on the other side is the employer, the insurance company and the company doctor with a tendency to deny the significance of injury in its relationship to disease. Physical therapists are interested in this question because many of the cases which they treat are diseases in which trauma may play a part, and the question of their fee rests on the decision of whether or not trauma caused the disease. In case trauma did cause the disease, the employer is responsible, or if not, then the patient will have to pay the bill.

This book presents authoritative data from which more accurate opinions may be formulated. It is a symposium to which twenty-four recognized authorities have contributed. The value of the opinions may be judged from a glance at a few of the contributors: Pemberton on chronic arthritis; Pollock on diseases of the nervous system; Roberts on diseases of the bones; Steindler on diseases of the spine; and de Takats on peripheral vascular diseases. This book can be recommended as presenting a complete accumulation of the knowledge concerning the relationship of a single trauma to disease.

WHAT IS OSTEOPATHY? By Charles Hill, M. A., M. D., D. P. H., Deputy Medical Secretary of the British Medical Association; and H. A. Clegg, M. A., M. B., M. R. C. P., Deputy Editor of the "British Medical Journal." With a preface by H. G. Wells. Cloth. Price, 7s., 6d. *Pp.* 217. *London: J. M. Dent & Sons, Ltd.,* 1937.

This is a book for the laymen who are curious to know what osteopathy is. The authors believed that the public should know the theories, the practice and limitations of osteopathy. Many people have been helped by osteopathy or it would not continue. The authors state: "We do not deny that people gain benefit by osteopathy, any more than we deny that people are helped by chiropraxy, Christian Science, naturopathy, electric belts, or by a belief that the world is about to come to an end." The authors also believe that the medical profession may be justly criticized for its tardiness in adopting and teaching manipulative methods. In this book the authors give the non-medical reader an account of what osteopathy is in the words of the osteopaths themselves. They show that osteopathy began with a number of generalizations for which there was no basis in reason, experiment, or observation.

Physical therapists should be interested in this volume to read themselves and as a book to give patients who ask "What is Osteopathy?"

THE BASIS OF CLINICAL NEUROLOGY. By Samuel Brock, M. D., Associate Professor of Neurology, College of Medicine, New York University; Senior Attending Neurologist, The Neurological Institute of New York; and Associate Neurologist, Bellevue Hospital, New York. Cloth. Price, $4.75. *Pp.* 347, *with* 72 *illustrations. Baltimore: Wm. Wood & Co.,* 1937.

Practically all human maladies are an expression of disturbed body physiology. The various functions of the body are dependent primarily upon the integrity of the nervous system. Thus it is that neurology, the study of the nervous system, reaches into all the specialties. Students of neurology must have a careful background of neuro-anatomy, neuro-physiology and neuro-pathology in order to understand the clinical syndromes related to the nervous system. In addition, the ever increasing activity of the research laboratory is supplementing the standard textbooks with new and important concepts. The author has seen the need for a correlation of these various aspects of neurology in an attempt to make the clinical syndromes more understandable. As a result an excellent book is available which students of neurology and allied subjects will find extremely valuable.

Chapters deal in order with the peripheral nervous system, the spinal cord, brain stem, cerebellum and cerebrum. Special chapters include the vascular supply of the spinal cord and of the brain with the clinical syndromes resulting from disturbed circulation, the vegetative nervous system and its function, and the cerebrospinal fluid. A chapter on posture summarizes very adequately our present knowledge of muscle tone. The author has very admirably accomplished what he set out to do; namely, to present the anatomic and physiologic basis of clinical neurology.

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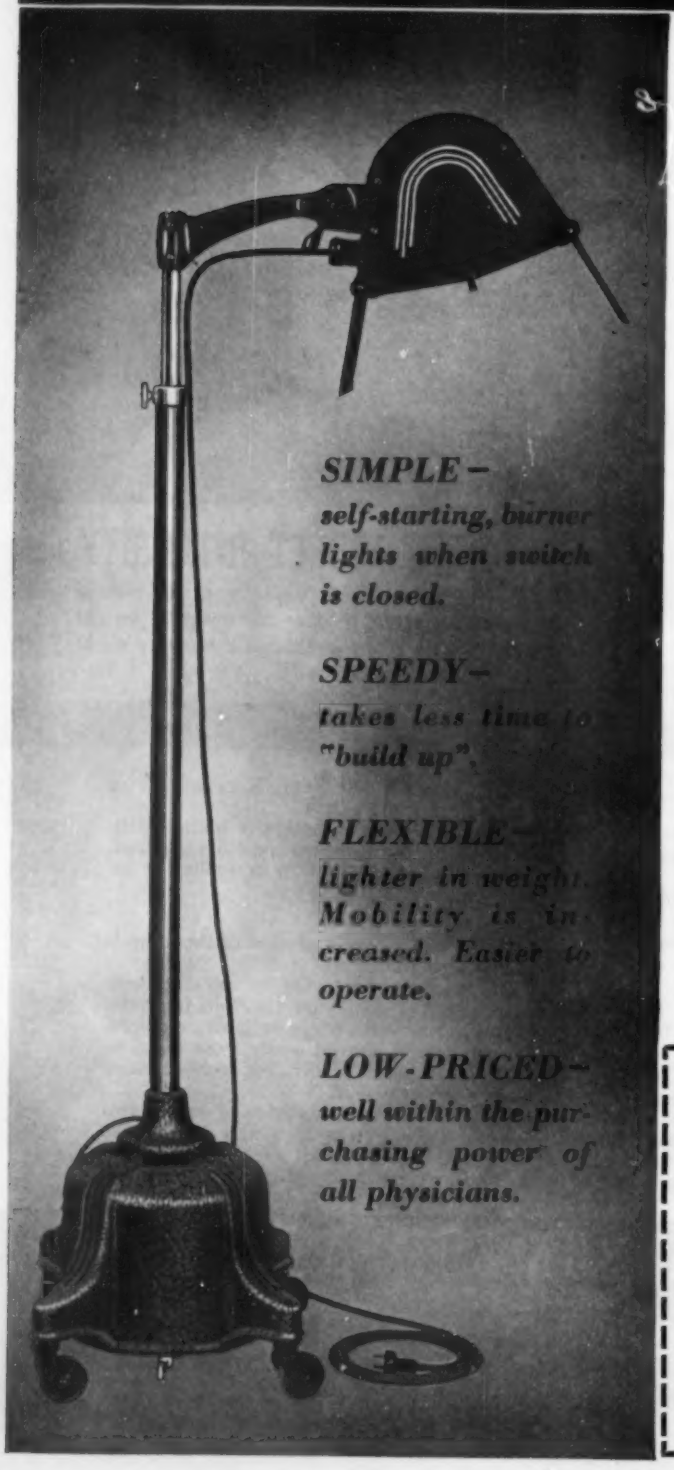
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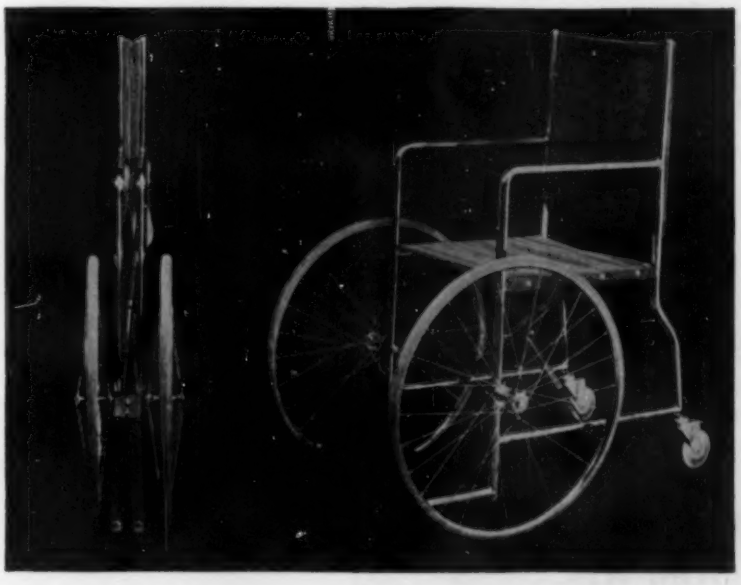

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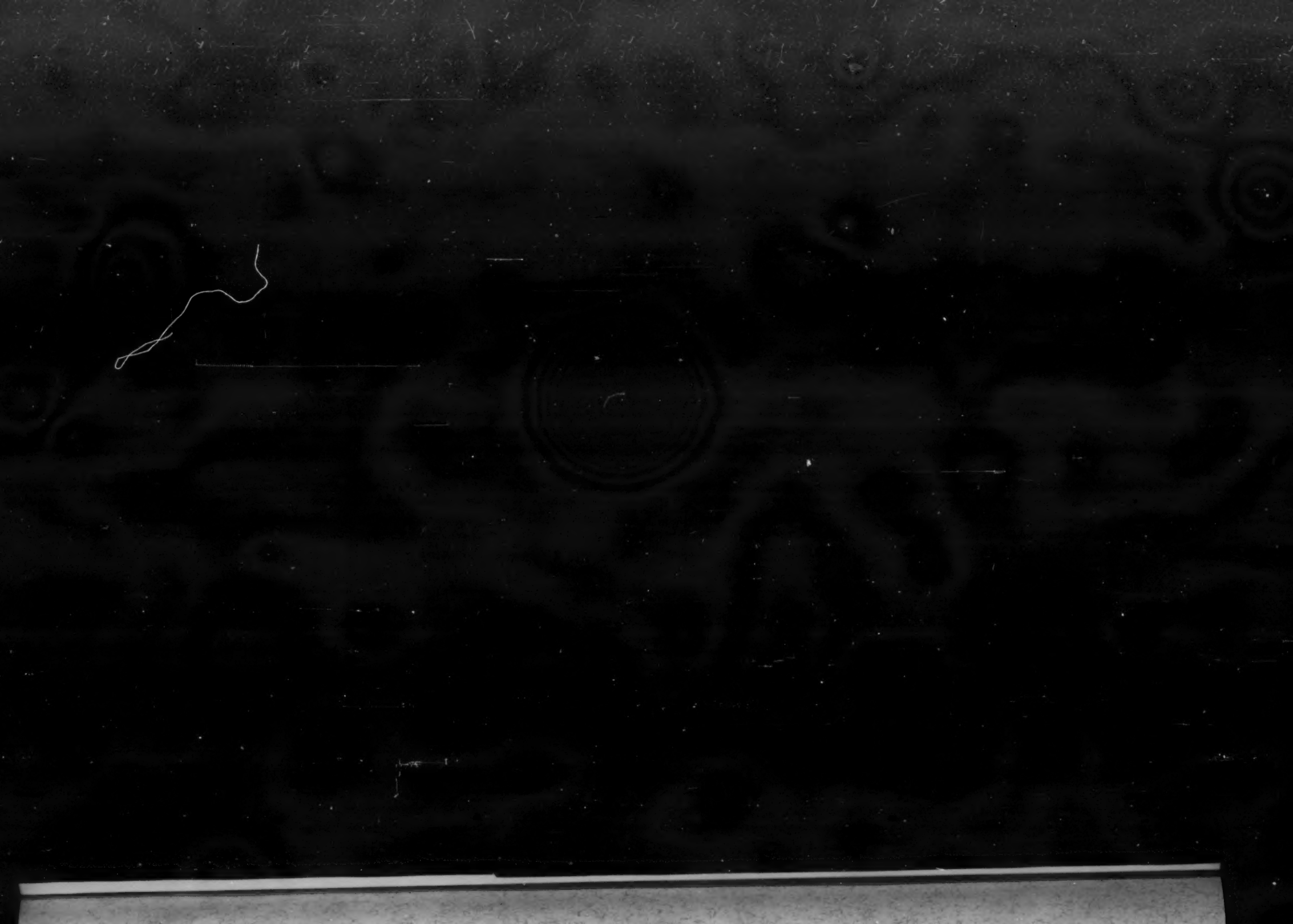
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